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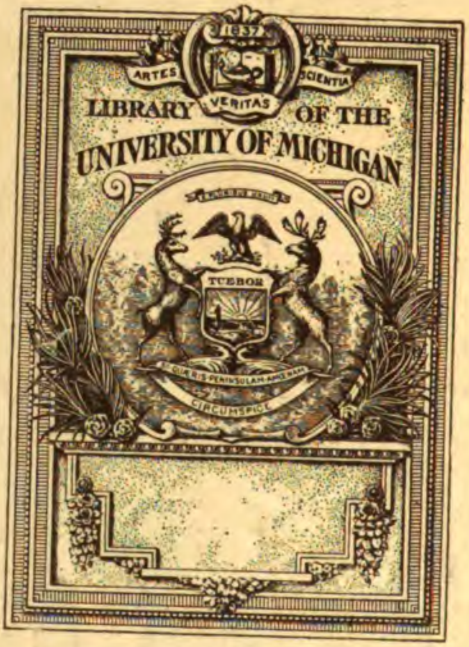

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The American Journal of Orthopedic Surgery

I.

AN INTRODUCTION TO THE SYMPOSIUM ON LATERAL CURVATURE.*

BY ANSEL G. COOK, M. D.

Orthopedic Surgery is the broadest specialty in the world, and lateral curvature of the spine can no longer be considered as a purely local condition, a matter of mechanical appliances.

If I have nothing new to offer, nothing original to tell you, nothing to say that you do not already know, my excuse for writing is that we do not always make the best use of the knowledge we have. Speaking after the manner of men, in order to fit shoes successfully, one must be able to think of 418 different things at the same time. If one thinks of only 417 things and forgets the 418th, and it happens to be the most important (which it usually is) the other 417 things go for nothing and the shoes are a failure. It is not easy to think of all these different things at the same time, to see them straight, and to be able to appreciate them at their true individual and relative values.

We can do nothing without a system, and that system is balance. Everything balances, must be made to balance, or it comes to grief. We are all, consciously or unconsciously, students of balance. Everything we do affects something or somebody else. Sometimes these effects are important and far-reaching, sometimes unimportant. There are all kinds of balances, bone balance, ligament balance and muscle balance. The veins must balance the arteries. There are local and general balances in our anatomy, and these balances act and react on one another.

---

* Read before the American Orthopedic Association at Washington, D. C., May, 1913.

For this one day will you regard everything from the standpoint of balance? For instance, should you be called upon to prescribe for a boy doubled up with the stomachache, do not hasten to declare that he suffers from green-apple colic. As a student of balance, your first thought should be, this boy has a bad balance; he has a postural curvature of the spine. You must not stop here, satisfied that you have made a diagnosis, and prescribe a brace or the regulation gymnastic exercises. You should reflect further and say that the curvature of the spine is caused by the spasmodic contraction of the muscles; that the contraction of the muscles is caused by the irritation of the nerves, and that the nerves are irritated by the green apple which lies in the pit of the boy's stomach. In order to correct the balance you must remove the apple. Perhaps this sounds like nonsense, but I assure you that I am absolutely serious. You may say that I have arrived at a perfectly obvious conclusion, after an unnecessary amount of circumlocution. This may be true, but the time wasted was not more than a minute or two: I did arrive at a correct conclusion, and I did not overlook anything.

This is the point. The habit of looking at everything as a question of balance gives you a system that helps you to think of the 418 different things at the same time.

If you remember that there is mental, moral and physical balance, no matter at what point on the circle you happen to start, you follow it around until you are able to grasp the whole situation.

It may be urged that the student of balance, while attempting so broad a view, embracing so many subjects, must of necessity become superficial and that the best work is done by specialists, who devote their entire attention to but one object. This, to a certain extent, is true, but you must learn to generalize before you can specialize. Specialists are very prone to build fences about themselves, over which they are unable to see.

One could not obtain a very clear idea of an elephant by an exhaustive and painstaking study confined exclusively to the tip of the elephant's tail. The student of balance, if he chances upon the tip of a tail, would know that there must be something on the other end and he would try to follow it up and find out what that something was. Of course, the student of balance will make mistakes. He will overestimate the importance of one element and underestimate the importance of another. He will find elements that he cannot control and others that he does not understand. His technical skill and knowledge may not be equal to the task before him, or again, if he has the skill and knowledge, he may not have the judgment and tact, but if he is a conscientious student of balance, he will not be blind. He will not forget or overlook things and he will be in a position to use whatever skill, knowledge, judgment and tact he may possess, to the best possible advantage.

A student of balance should make careful study of his patient as a whole; how he stands, walks, runs; how he carries himself; what his occupation; what the state of his general health and what the development of his muscles. Has he any injury or deformity and how do any and all of these things affect his balance?

A man may be compared to a pyramid standing on its apex. Moreover, he is a flexible pyramid. He has a skeleton composed of 200 bones and a joint at each end of each bone. He is enabled to stand and keep his balance only by the constant exercise of the strength and coördination of his muscles. If for any reason he loses his balance, he falls to the ground. Now there are an infinite variety of positions a man may assume and still keep on his feet and keep his balance, but some of these positions involve a much greater strain on the tissues than do others, and no one position in standing can be maintained for any great length of time without overstraining the muscles.

In a solid pyramid balanced on its apex, the center of gravity must be exactly over the apex. If it varies by a hair's breadth, the pyramid falls.

When a ballet-dancer stands on one toe, the center of gravity must be exactly over the toe. Her flexible body enables her to assume a variety of attitudes without disturbing the balance, but if one part of her body is bent forward, another part of equal weight must be bent backward to preserve the equilibrium.

It is a fundamental principle of mechanics that when a body is in equilibrium, a vertical line drawn through the center of gravity must fall within the base. We know that the resultant of all the forces which gravity exerts on the particles of the body passes through the center of gravity. Hence, if this point be supported, the whole body is supported.

"Wolff, in his law of functional adaptation, shows that if any part of the anatomy is changed from the normal posture to the abnormal, and habitually used, the structures involved undergo a change throughout their entire texture to adapt themselves to the new position. The converse is also true, *i.e.*, if a deformity in which the parts involved have become changed in their shape, is brought back to a corrected position and used, these parts again undergo a change and become normal in their contour." For example, should we wish to correct a lateral curvature of the spine, bearing in mind Wolff's law, and the principles of balance, the problem would be to so displace the center of gravity that the force exerted by the attraction of gravitation works to correct and not to increase the deformity. Then Wolff's law works for you and not against you. In order to accomplish this, first try to locate the center of gravity; try to locate the center of motion; try to locate the center of stress.

Remember that a column must have a base, and that the size and angle of the base have a great effect on the superstructure. Remember that force can be brought to bear directly or indirectly on the center of motion. Start with a clear, definite idea of what you are trying to do, and if you cannot do it in one way, you probably can in another. If braces, shoes and corsets fail to sufficiently displace the center of gravity, you can resort to superimposed weight. All of the weight acts as if it were situated at the center of gravity. If you increase the weight unequally, you force the patient to change his attitude in standing, in order to bring the center of gravity over his base of support. A 5-pound bag of shot carried on one shoulder or one hip for a month will have more effect than one would imagine who has never tried it; or, failing in this, one may resort to recumbency, and thus to a certain extent eliminate the attraction of gravitation, etc., and lastly (perhaps I should have said firstly, for it is often best) you may resort to surgery.

Should you correct a badly set Pott's fracture of the ankle by taking a wedge out of the lower end of the tibia, you might not only straighten the foot, but also cure a strained and painful knee, hip, or sacroiliac joint, or straighten a twisted spine. Center of gravity, center of motion, center of stress. Or, starting from the top, by cutting a contracted sternomastoid tendon, you would not only correct a torticollis, but also cure a lateral curvature of the spine.

By removing the supraspinatous portion of a curved scapula, you might not only straighten an anteroposterior curvature of the spine, but cure a pendulous abdomen, displaced kidney, strained sacroiliac or hip, knock-knee, pronation and depression of both arches of the foot and ingrowing toe-nail. Again, center of gravity, center of motion, center of stress.

I distinctly remember that in the days of my youth, when I had a weakness for pointed-toed shoes, that an ingrowing toe-nail once caused a very troublesome lameness in my right hip. Instinctively, to avoid pressure on the toe, I walked on the outer side of my foot. This, as it chanced, though it relieved the toe, brought an undue strain on the muscles of the hip. All my symptoms were referred to the hip; the original cause seemed quite insignificant, and yet, no amount of treatment applied to the hip would ever have brought about a cure.

As the logical sequence of the foregoing, and briefly, for the time allotted to me has nearly expired, let me present for your consideration a fenestrated corset and a webbing band.

If the rod *A E* is subjected to a pressure of 100 pounds at the point *C*, and meets with resistance or counter-pressure at the points *B* and *D* equally distant from the point *C*, there must be a pressure of 50 pounds at the point *B* and a pressure of 50 pounds at the point *D*. This is the principle of the osteoclast;

one point of pressure and two points of counter-pressure. But why not pull? It is easier to pull than to push. This is the principle of the bow-leg brace and the principle of the knock-knee brace. One point of pull and two points of resistance. Why not apply the same principle to the spine? The lumbar spine is the center of motion of the human body. You are all familiar with the leather shingle, how, supplemented with an ordinary corset, it fixes the center of motion in antero-posterior curvature. Now apply the same principle to lateral curvature. *If you can reverse the lateral curve of the lumbar spine,* you must of necessity reverse the whole balance of the human body.

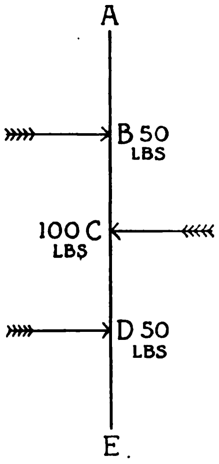


FIG. 1.

Thus, for example, if the lumbar spine be curved to the left, and the right hip high and the right shoulder low, and you can cause a reversal of this curve so that the lumbar spine is curved to the right, you will find the right hip low, and the right shoulder high. This at first glance may sound too simple to be true. I am aware that all curvatures of the lumbar spine to the left are not accompanied by right hip high and right shoulder low. There are such things as compensatory curves of the spine and compensatory tiltings of the pelvis and rotations of the spine on its own axis, etc., ***but the fact remains that the lumbar spine is the center of motion of the human body. Nor does it matter whether the curve of the lumbar spine be primary or compensatory.*** If the lumbar spine is abnormally curved to the left and you can cause it to be curved to the right, you have changed the entire balance of the whole body, and all the factors, gravity modified by anatomical conditions, Wolff's law, etc., which formerly worked to produce the deformity, will now work to correct the deformity.

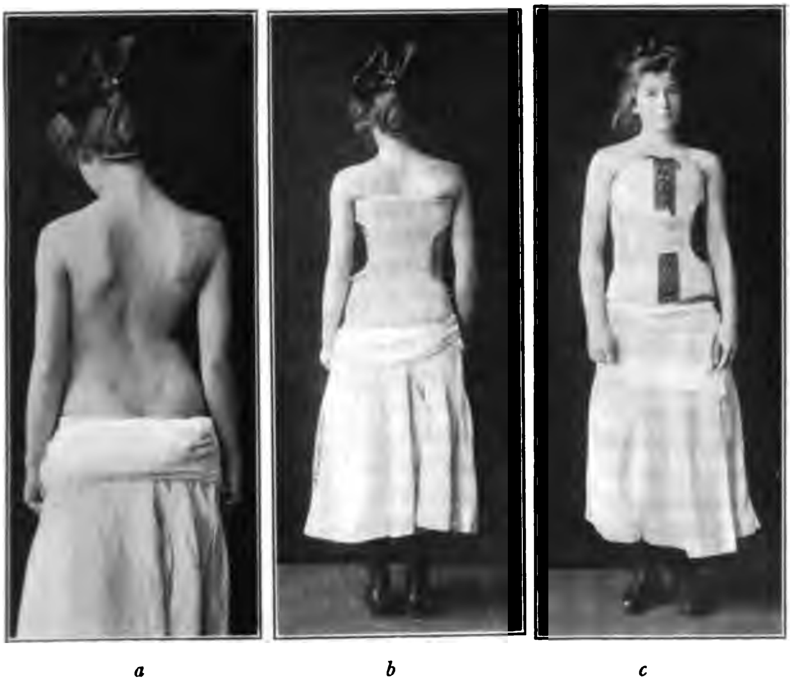
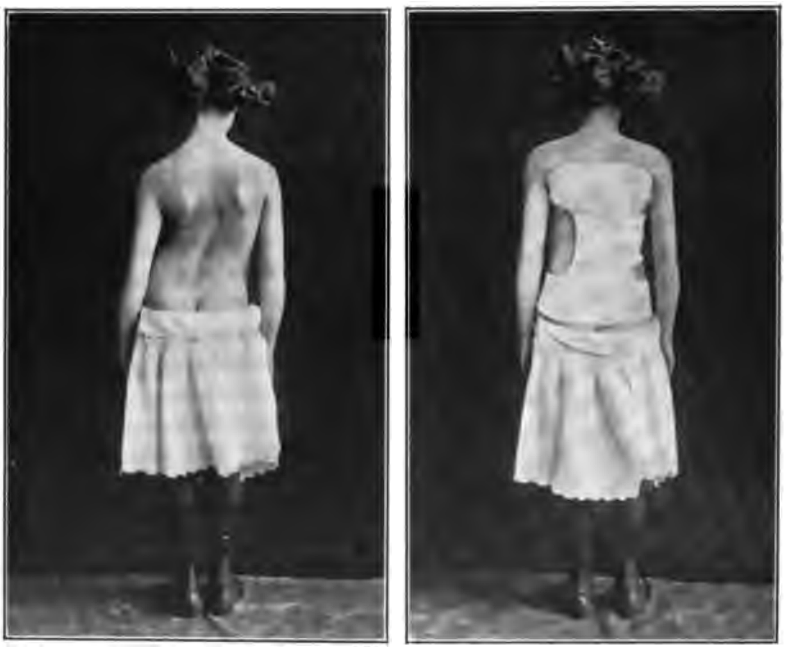


FIG. 2. CASE I.—(*a*) Right hip high; left arm hangs close to body. (*b*) Corset applied, posterior view. Notice position of left arm. (*c*) Corset applied, anterior view. Notice position of left arm.

The key to the whole situation is the lumbar spine. The lumbar spine is the natural center of gravity, center of motion and center of stress of the whole human body. Torticollis, flat-foot, club-foot, ingrowing toe-nail, unilateral knock-knee, bow-leg, diseases of, injuries to or abnormalities of, the ankle, knee, hip, and sacroiliac joints, pendulous abdomen and curved scapulæ, in fact anything and everything that affects the balance of the body, affects the curve of the lumbar spine. All these factors (the 418 different things) must be taken into consideration and accounted for, but we must not magnify nor exaggerate their importance, nor allow ourselves to be diverted by side issues.



a *b*

Fig. 3. Case II.—(*a*) Left hip high; left shoulder low. (*b*) Corset applied.

In the mechanical treatment of lateral curvature of the spine, the primary object should be to reverse the lumbar curve. Everything that prevents the reversal of the lumbar curve must be eliminated. If you can once reverse the lumbar curve and hold it, you may *count your cure.* Rotations of the spine on its own axis, tiltings of the pelvis, high or low shoulders, will regulate themselves and require no special attention.

The fenestrated corset is an ordinary plaster-of-Paris corset made in the usual manner. A large window is cut on either side, a broad webbing band passes over the convexity of the lateral curve of the lumbar spine, doubles over the edge of the windows on the opposite side of the corset, returns and buckles. The edges of the window over which the webbing band turns are reinforced with thin strips of steel riveted to the corset.

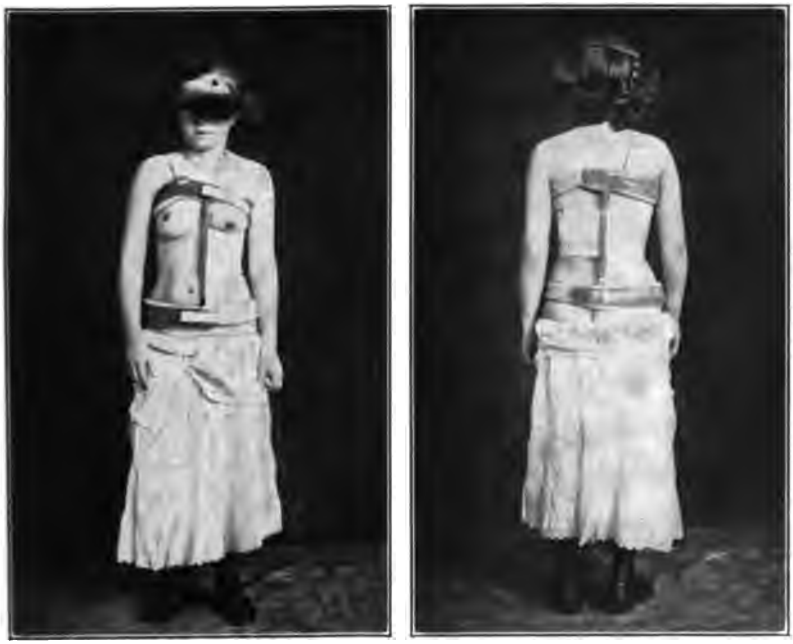

Anterior View. Posterior View.

FIG. 4.—Leather and steel brace.

The corset is made to lace in the front so that it can be readily removed.

The fenestrated corset acts directly on the lumbar curve. The pull is over the convexity of the curve and the resistance is divided between the hip and thorax of the opposite side. Pressure can be easily regulated, increased or diminished, to any extent, without even removing the corset. To obtain the best results, pressure should be constant, and the corset worn night and day.

If the patient is in a hospital and under full control, the corset can be made much more efficient by making it longer, thus increasing the leverage, and bringing a greater pressure to bear on the center of motion and center of stress. If you wish, you may even continue the corset downward over the hip and encircle the thigh and upward over the shoulder, and encircle the arm. Thus, by tilting the pelvis, and the yoke made by the clavicles and sternum, in front, and the scapulæ behind, bend the whole spine, and thus indirectly increase the pressure on the center of motion, and the center of stress, and still further displace the center of gravity.

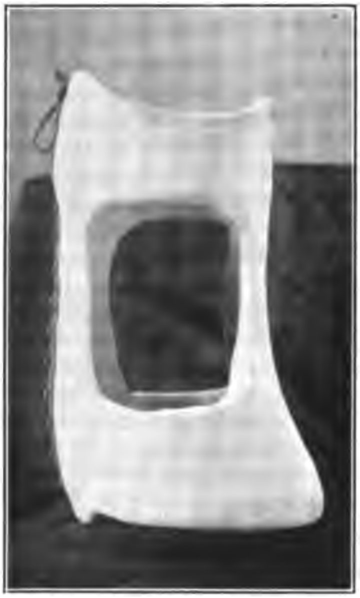


FIG. 5.—Fenestrated corset. Lateral view.

If you believe that by bending the body forward you can unfasten the interlocked transverse processes of the spinal vertebræ, by all means make your original corset with the body in this position, and then cut your windows and proceed as before.

Personally, at the present time, I cannot see why the transverse processes should be locked, and how, assuming them to be locked, that bending the body forward will unlock them. On the other hand, I am not prepared to say that this is not the case. It is possible that before the day is over I may see the light. "Mr. Pickwick's, like all great minds, was open to conviction."

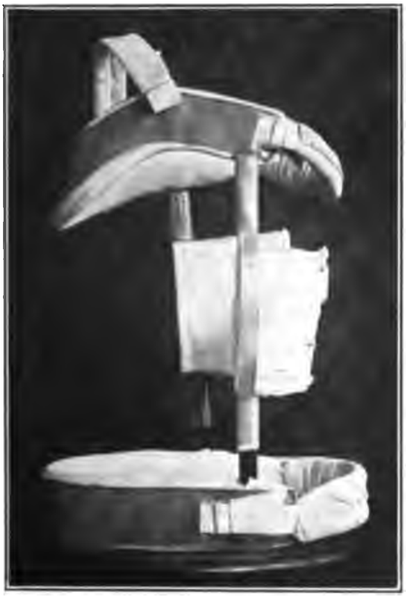


FIG. 6.—Leather and steel heavily padded brace. On the whole less efficient and less comfortable than the fenestrated corset.

The fenestrated corset, the ordinary one that does not extend below the hips or above the axilla, the only one with which I have had any actual practical experience, is very comfortable, and patients always like it, because they can see for themselves just what is being accomplished. They soon learn to regulate the pressure for themselves, and become the enthusiastic partners of the physician. The improvement is always marked; at first they can see the hollow side filling up, and the flesh bulging into the opening in the corset, and are greatly encouraged.

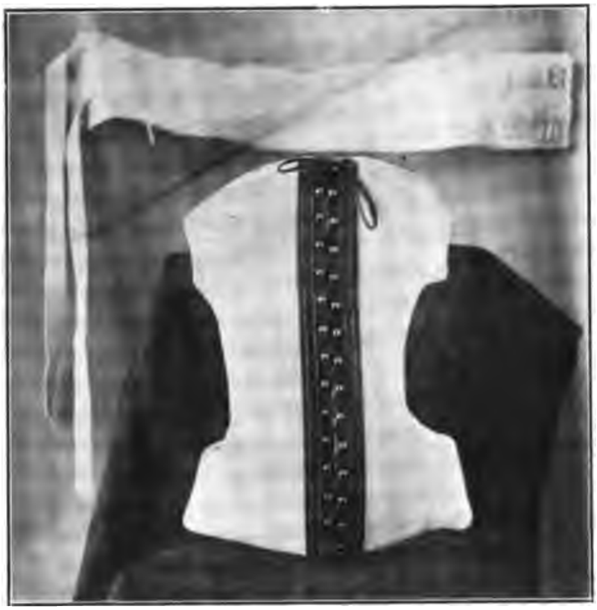


FIG. 7.—Fenestrated corset and webbing band.

The patients literally pull themselves out of a hole, and wriggle themselves straight as they come through.

II.

MOVEMENTS OR POSITIONS OF THE NORMAL SPINE AND THEIR RELATIONS TO LATERAL CURVATURE.*

BY E. G. ABBOTT, M. D., PORTLAND, MAINE.

The movements or positions of the normal spine are many and, like any flexible body, it may be bent in almost any position.

There are so-called primary movements in which the vertebral column bends only in one direction; there are movements in which it bends in two; and finally there are those in which it moves in three or more at the same time.

The vertebral column in childhood is very flexible, and when placed in any of the different positions shows marked and distinctive changes from the normal erect spine. These changes are not only apparent when it is viewed as a whole, but also when the individual parts are examined. The adult spine acts similarly to that of a child, but as motion is not so free, the changes from one position to another are not so plainly demonstrable.

It is, however, with the spines of children that we are concerned, as most cases of lateral curvature develop in early life, and it seems only necessary to bear in mind the fact that the same changes which take place in a child's spine may be found in an adult's, only motion is more limited.

The passive movements of the spine appear to be of more importance than the active, since muscle action infrequently produces deformity in the normal individual and in those instances where it does it may be looked upon rather as a passive than as an active condition.

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* Read before the American Orthopedic Association, May, 1913.

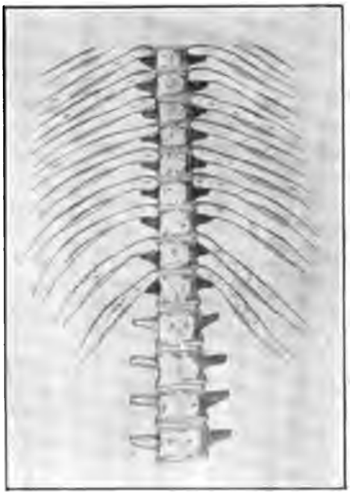


FIG. 1.

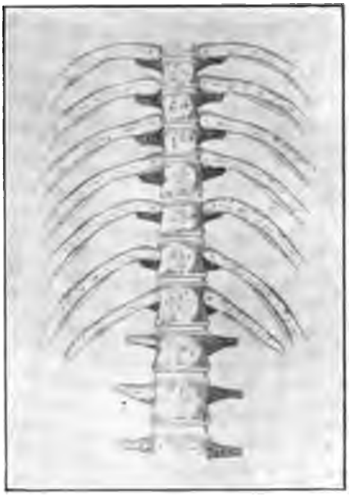


FIG. 2.

FIG. 1.—Erect—pelvis, thorax and shoulders on the same plane with muscles relaxed.

FIG. 2.—Flexion—pelvis, shoulders and thorax on the same plane with the body in the position of complete flexion.

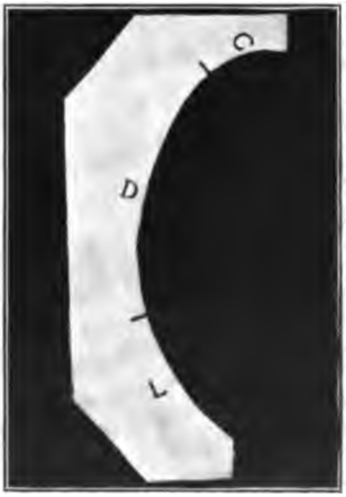


FIG. 3.

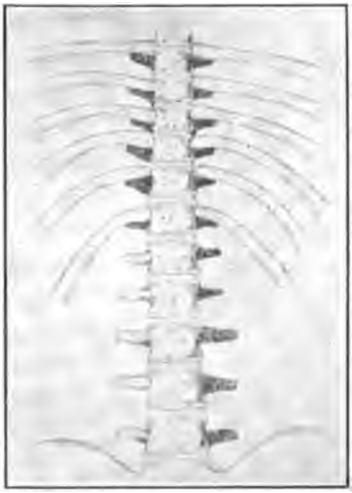


FIG. 4.

FIG. 3.—Flexion—paper model cut to fit the spine with the body in the position of complete flexion.

FIG. 4.—Extension—shoulders, thorax and pelvis on the same plane with the body in the position of complete hyperextension.

It is hardly necessary at this time to describe the anatomical differences of the three segments of the spine, as they seem to have very little, if any influence, except in the degree of change, upon the various positions in which a model may be placed, and consequently do not seem to effect any considerable control over the development of scoliosis. It also seems wholly unnecessary to divide the spine into its different segments and consider their flexibility separately in order to understand correctly the pathological changes found in lateral curvature. It is of importance, however, to note the relations of the individual parts of the spine as it is bent in different directions, either by muscular contraction or by manipulation, as scoliosis appears to develop from placing a person in a certain position, also as the deformity can be removed by reversing this position.

There are apparently five primary movements of the spine: (1) flexion; (2) extension; (3) side bending; (4) rotation; (5) torsion.

Beginning with the spine in a straight position, Fig. 1, we find that flexion or forward bending is an antero-posterior movement, Fig. 2, and in childhood the spine forms an arc of a circle, Fig. 3. The greatest change occurs in the lumbar region which becomes decidedly convex posteriorly. The dorsal region becomes more convex and the cervical portion which is freely movable changes its anterior convexity to a marked posterior.

Hyperextension, or backward bending, is also an antero-posterior movement, Fig. 4, and the spine approaches an arc of a circle although it is somewhat irregular. The whole spine is convex anteriorly, Fig. 5, markedly so in the lumbar and cervical regions, but the dorsal does not completely lose its posterior convexity.

Lateral bending apparently may be also a pure movement, Fig. 6, and form nearly an arc of a circle, but, as in hyperextension, it is somewhat irregular, Fig. 7.

Rotation.—It would seem best to apply the terms rotation and torsion to two distinct movements of the spine. In scoliosis we find that the vertebræ turn vertically, and the greatest

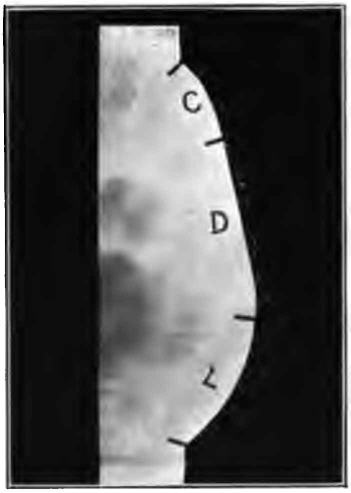


FIG. 5.

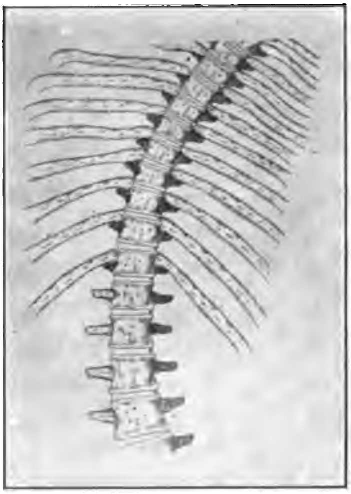


FIG. 6.

FIG. 5.—Extension—paper model cut to fit the spine with the body in the position of complete hyperextension.

FIG. 6.—Lateral bending—pelvis, shoulders and thorax on the same antero-posterior plane with the body in the position of side bending.

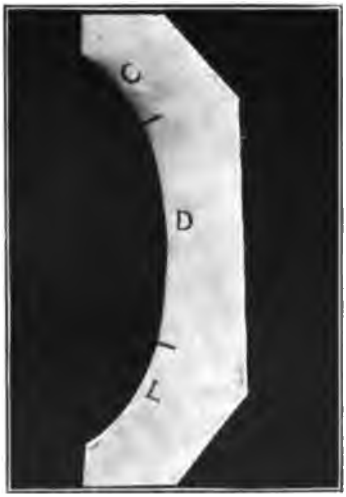


FIG. 7.

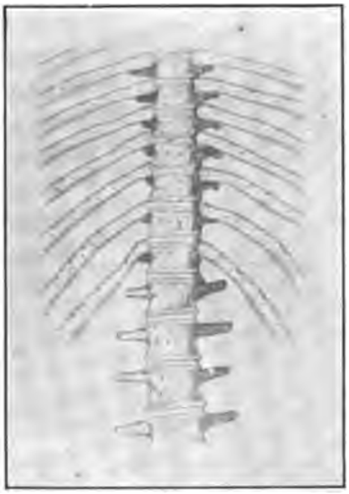


FIG. 8.

FIG. 7.—Lateral bending—paper model cut to fit the spine with the body bent laterally to the limit of normal motion.

FIG. 8.—Rotation—shoulders and pelvis held on the same plane, and the body turned on its vertical axis.

change is found at the middle or apex of the curve, while those at either end are in a normal position, and to this movement of the spine the term rotation is here used.

There is, however, another twisting movement of the vertebral column in which the greatest change is found at either end of the spine, and to this movement, which is distinctly different from the one which we have named rotation, the term torsion is here used. For example, if one grasps firmly a short piece of rope by either end, and a second person seizes it with one hand near the middle and twists it, the greatest change takes place at the center. On the other hand, if one grasps a rope in the same manner, *i.e.*, by either hand, holding one end securely while he turns the other the greatest change will be at the ends. These two movements would be entirely distinct and one would bear no relation to the other.

Rotation is a pure movement, Fig. 8, and the greatest change in the position of the vertebræ from that of the correct anatomical takes place at the center of the part entering into the rotation.

Torsion is also a pure movement, Fig. 9, and the change here in the twisted vertebræ is greatest at either end of the spine. For example, if the pelvis is firmly held and the head turned, the greatest change from the anatomical position occurs at the upper cervical vertebra.

The compound movements of the spine in which it is bent in two directions at the same time are (1) flexion plus side bending; (2) flexion plus rotation; (3) flexion plus torsion; (4) extension plus side bending; (5) extension plus rotation; (6) extension plus torsion; (7) side bending plus rotation; (8) side bending plus torsion.

Flexion plus side bending is a movement in which the spine is bent forward and to one side at the same time, Fig. 10. In this movement the bodies of the vertebræ do not necessarily turn toward either side.

Flexion plus rotation is also a movement in which the spine moves in only two directions at the same time, Fig. 11. It bends forward and a certain number of the vertebræ turn

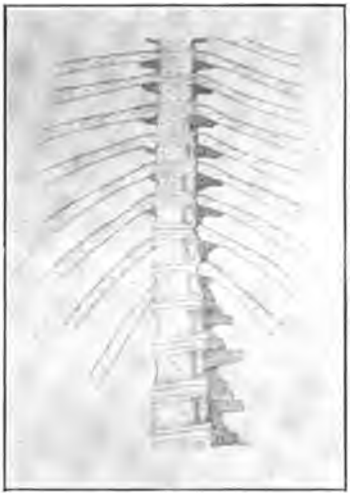


FIG. 9.

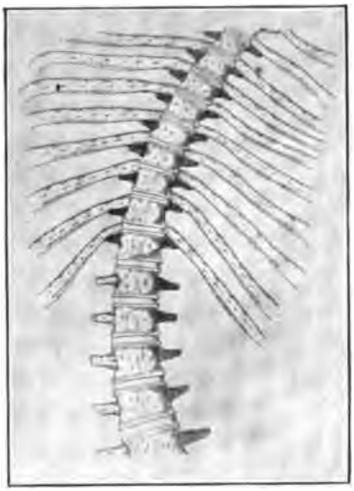


FIG. 10.

FIG. 9.—Torsion—head, shoulders and thorax firmly held and pelvis twisted on its vertical axis.

FIG. 10.—Flexion plus side bending—shoulders, thorax and pelvis held on the same antero-posterior plane, spine flexed and bent laterally.

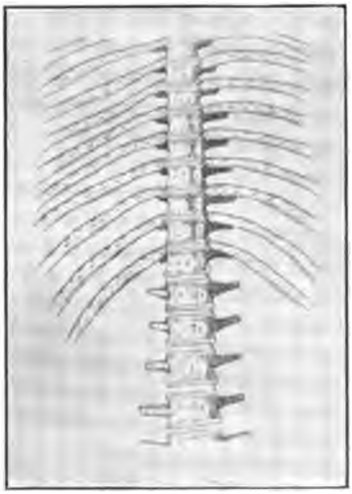


FIG. 11.

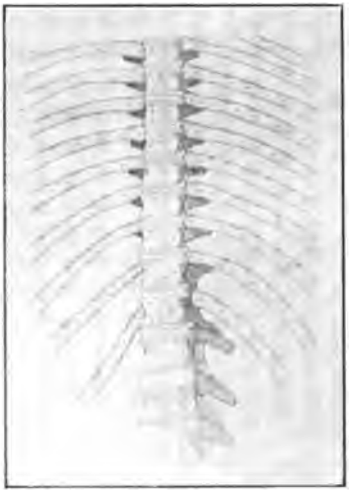


FIG. 12.

FIG. 11.—Flexion plus rotation—pelvis and shoulders held on the same plane spine flexed and the body turned on its vertical axis.

FIG. 12.—Flexion plus torsion—shoulders and head firmly held, spine flexed and pelvis twisted on its vertical axis.

either to the right or left. This movement is not necessarily accompanied by any lateral bending.

Flexion plus torsion is a movement in which the spine bends forward, and one end turns either to the right or left, Fig. 12, and is not necessarily accompanied by any lateral bending.

Extension plus side bending is a movement in which the spine bends backward, and at the same time to one side, Fig. 13, and there is no torsion or rotation.

Extension plus rotation like flexion plus rotation is a movement in only two directions. The spine is bent backward, and at the same time the bodies of the vertebræ turn either to the right or left without any lateral deviation, Fig. 14.

Extension plus torsion is a movement in which the spine bends backward and at the same time one end turns either to the right or left, and the greatest change in the direction of the bodies of the vertebræ is at the end twisted, Fig. 15.

Side bending plus rotation is a movement of the spine limited to two directions. It is bent laterally and at the same time a part of the vertebræ turns either to the right or left and the greatest change in the direction of the bodies of the vertebræ is at, or near the center of the lateral bend, Fig. 16.

Side bending plus torsion is also a movement of the spine limited to two directions. It bends laterally and at the same time the vertebræ turn either to the right or left and the greatest change in the direction of the bodies is at one end, Fig. 17.

The more complex movements of the spine, *i.e.*, those in which it moves in three directions at the same time, are limited. There are four, however, in which the column may easily be placed: (1) flexion, plus lateral bending, plus rotation; (2) flexion, plus lateral bending, plus torsion; (3) extension, plus lateral bending, plus rotation; (4) extension, plus lateral bending, plus torsion.

Flexion, plus lateral bending, plus rotation is a movement in which the spine bends forward, laterally, and the vertebræ rotate on their vertical axes. The greatest amount of rotation is found near the apex of the lateral bend, while at the extremities of this curve the bodies do not turn, Fig. 18.

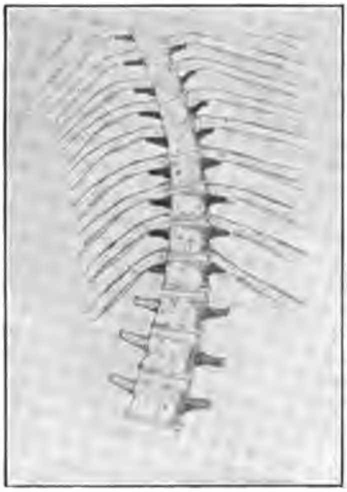


FIG. 13.

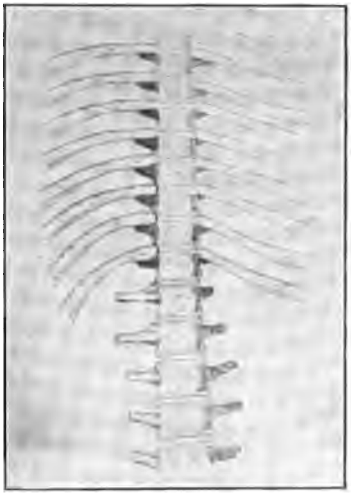


FIG. 14.

FIG. 13.—Extension plus side bending—pelvis and shoulders held on the same plane, spine hyperextended and bent laterally.

FIG. 14.—Extension plus rotation—pelvis and shoulders held on the same plane, spine hyperextended and body turned on its vertical axis.

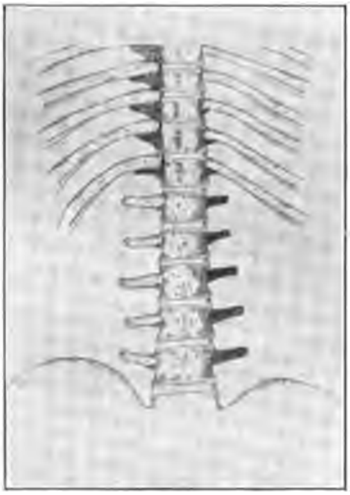


FIG. 15.

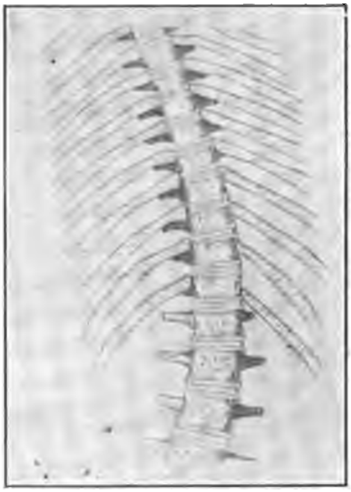


FIG. 16.

FIG. 15.—Extension plus torsion—pelvis firmly held, spine hyperextended, and shoulders and head twisted on their vertical axes.

FIG. 16.—Side bending plus rotation—pelvis and shoulders held on the same antero-posterior plane, spine bent laterally and the body turned on its vertical axis.

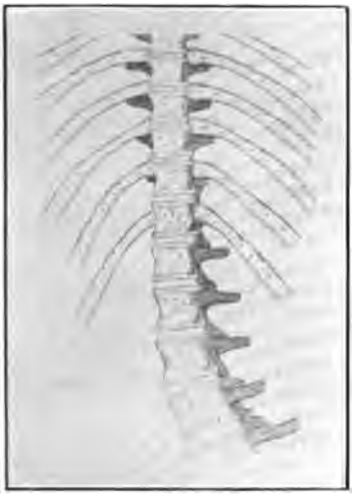


FIG. 17.

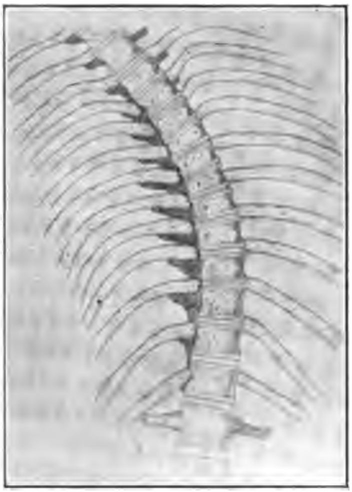


FIG. 18.

FIG. 17.—Side bending plus torsion—head, shoulders and thorax firmly held, spine bent laterally, and pelvis twisted on its vertical axis.

FIG. 18.—Flexion plus side bending plus rotation—pelvis and shoulders held on the same antero-posterior plane, spine flexed, bent laterally, and the body turned on its vertical axis.

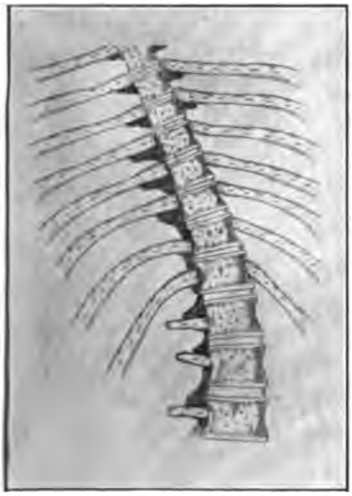


FIG. 19.

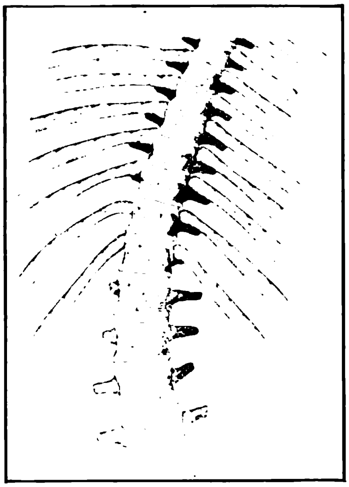


FIG. 20.

FIG. 19.—Flexion plus side bending plus torsion—head, shoulders and thorax firmly held, spine flexed, bent laterally and pelvis twisted on its vertical axis.

FIG. 20.—Extension plus side bending plus rotation—pelvis and shoulders held on the same antero-posterior plane, spine hyperextended, bent laterally and body turned on its vertical axis.

Flexion, plus lateral bending, plus torsion is a movement in which the spine bends forward, and to one side, the vertebræ turn on their vertical axes, but in this movement the greatest amount of change takes place at that end of the column which is twisted, Fig. 19.

Extension, plus lateral bending, plus rotation is a movement in which the spine bends backward and to one side, the vertebræ rotate on their vertical axes, and the rotation is most apparent at the apex of the lateral bend as it is in flexion, Fig. 20.

Extension, plus lateral bending, plus torsion is a movement in which the column bends backward, and to one side, the vertebræ turn on their vertical axes, and as in flexion the greatest apparent change is at the end of the spine which is twisted, Fig. 21.

These compound movements are of particular importance in their relation to scoliosis, as in a typical case of this deformity we find the spine not only bent to one side, but the vertebræ turned on their vertical axes and the greatest amount of rotation is at the apex of the lateral bend, Fig. 22.

In the first of these positions, *i.e.*, flexion, plus lateral bending, plus rotation, the spine bends forward and to either side with equal ease, and the vertebræ may be rotated with little force, so that their bodies are directed either toward the convexity, or concavity of the lateral curve, but seem to turn toward the convexity more readily, Figs. 23 and 24.

In the second position—flexion, plus lateral bending, plus torsion—the spine bends forward and to either side and the vertebræ turn in either direction that the end of the column is twisted, but the turning of the vertebræ is wholly unlike that found in scoliosis, as the greatest amount of change is found at the ends of the lateral bend rather than at the middle, Fig. 25.

In the third position—extension, plus lateral bending, plus rotation—the spine bends backward and to either side with equal ease, and the vertebræ may be rotated with considerable force so that the bodies may be directed either to the convexity or the concavity of the lateral curve, but seem to rotate toward the concavity more easily, Figs. 26 and 27.

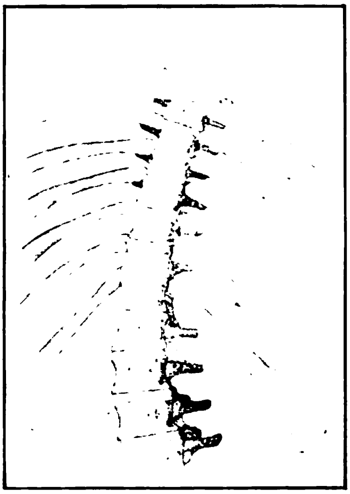


FIG. 21.

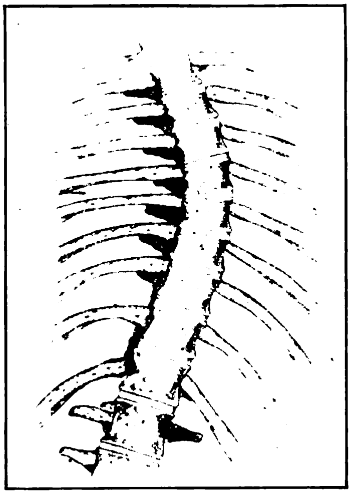


FIG. 22.

FIG. 21.—Extension plus side bending plus torsion—head, shoulders and thorax firmly held, spine hyperextended, bent laterally and pelvis twisted on its vertical axis.

FIG. 22.—Typical scoliosis—showing the characteristic rotation of the vertebræ.

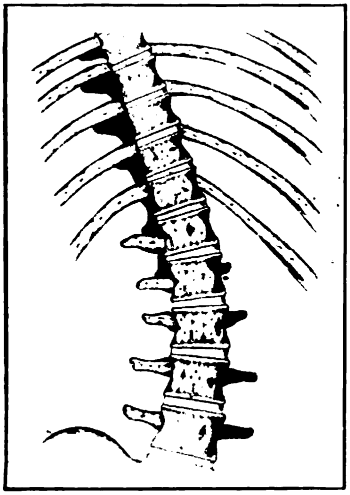


FIG. 23.

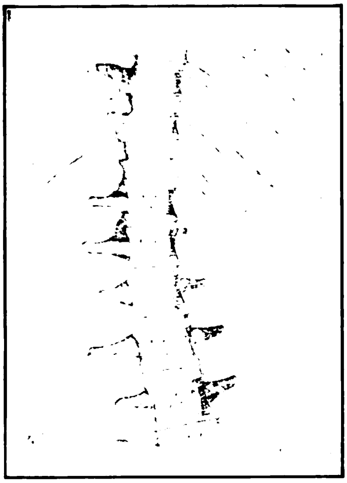


FIG. 24.

FIG. 23.—Flexion plus side bending plus rotation—pelvis and shoulders held on the same antero-posterior plane, spine flexed, bent laterally, and the body turned on its vertical axis so that the bodies of the vertebræ turn toward the *convexity* of the lateral curve.

FIG. 24.—Flexion plus side bending, plus rotation—pelvis and shoulders held on the same antero-posterior plane, spine flexed, bent laterally, and the body turned on its vertical axis so that the bodies of the vertebræ turn toward the *concavity* of the lateral curve.

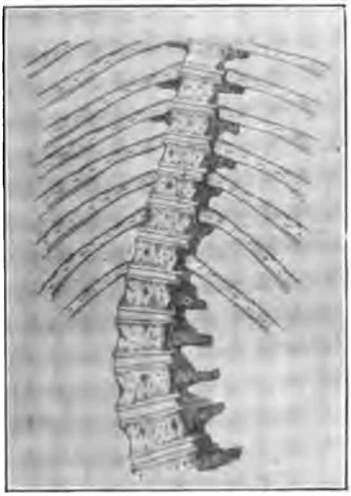


FIG. 25.

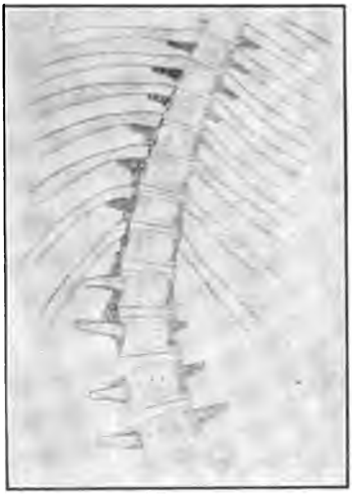


FIG. 26.

FIG. 25.—Flexion plus side bending plus torsion—head, shoulders and thorax firmly held, spine flexed, bent laterally, and the pelvis turned on its vertical axis.

FIG. 26.—Extension plus side bending plus rotation—pelvis and shoulders firmly held on the same antero-posterior plane, spine hyperextended, bent laterally, and the body rotated on its vertical axis so that the bodies of the vertebræ turn toward the *concavity* of the lateral bend.

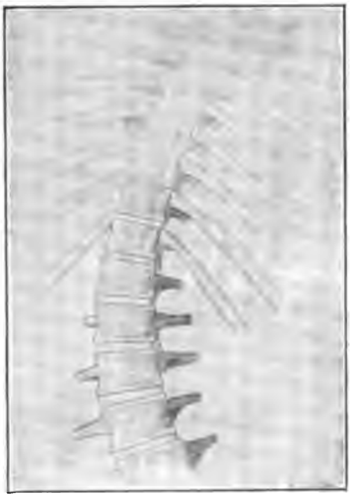


FIG. 27.

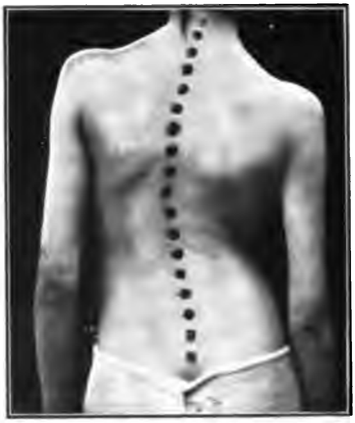


FIG. 28*a*.

FIG. 27.—Extension plus side bending plus rotation—pelvis and shoulders held on the same antero-posterior plane, spine hyperextended, bent laterally and the body rotated on its vertical axis so that the bodies of the vertebræ turn toward the *convexity* of the lateral bend.

FIG. 28*a*.—Model in the position of active physiological scoliosis—single curve.

In the fourth position the spine moves the same as in the second, except that it bends backward instead of forward.

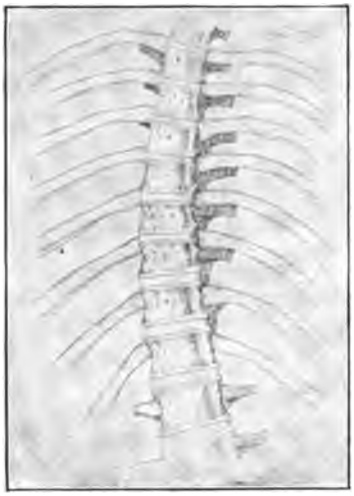
In analyzing these different positions it seems possible to place the spine in almost any direction or combination of directions. On the other hand it has been found that in order to put it in any of the postures approaching that of a typical scoliosis, with one exception, considerable force is necessary and the movement is limited.

If a model is bent forward and to one side and a twisting force applied which will turn the bodies of the vertebræ toward the convexity of the lateral curve, the result shows that the spine easily assumes the same position as that found in scoliosis.

It is the position of flexion, plus lateral bending, plus rotation of the bodies of the vertebræ toward the convex side of the lateral bend, and in this movement one shoulder is elevated and the other lowered. It is the same faulty position that the school child assumes when he sits more or less sidewise at a desk writing, Fig. 30. Experimentation seems also to show that the pelvis acts upon the lumbar spines in a similar manner to that of the shoulders on the dorsal, Fig. 31.

That the position of lateral curvature is a normal physiological active position, assumed at will frequently during the ordinary every-day activities of life, seems to be easily demonstrable, Fig. 28*a*, 28*b*. That this active physiological scoliosis may become passive, forming a double curve of the spine differing only in degree from that of the pathological seems clear, Fig. 29*a*, 29*b*. It is perfectly easy after finding this position to hold the model a sufficient length of time in a plaster corset until the same changes as those found in a typical lateral curvature take place and the deformity becomes fixed, Fig. 32*a*, 32*b*, but it seems to be more difficult to prove positively why an individual should develop such a distortion.

From observations made on a large number of models it appears that the muscles controlling the rotation movement of the dorsal spine have their fixation point above on the convex side of the lateral bend, and pull the ribs upward and backward, causing the bodies of the vertebræ to turn toward this side. At



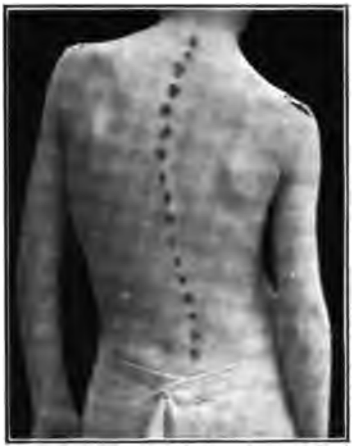
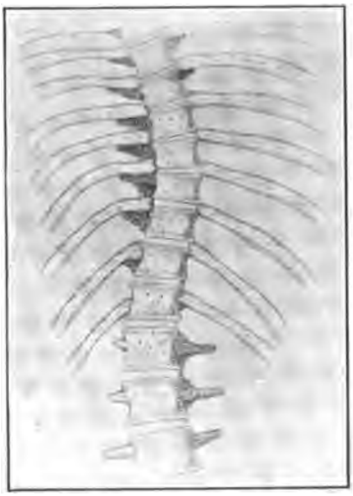


FIG. 28*b*.

FIG. 29*a*.

FIG. 28*b*.—Posture of active physiological scoliosis—single curve.

FIG. 29*a*.—Model in the posture of passive physiological scoliosis, muscles relaxed weight borne on one leg, double curve.



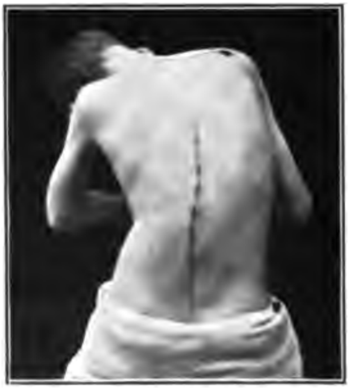


FIG. 29*b*.

FIG. 30.

FIG. 29*b*.—Posture of passive physiological scoliosis—double curve.

FIG. 30.—Position of physiological scoliosis. A posture frequently assumed by school children.

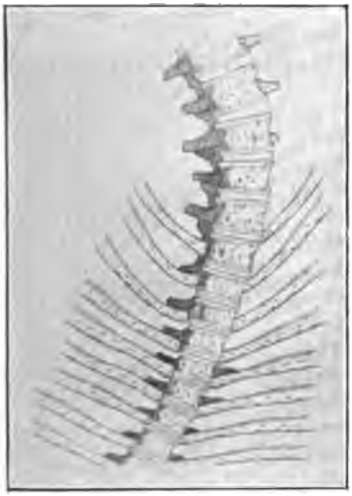


FIG. 31.

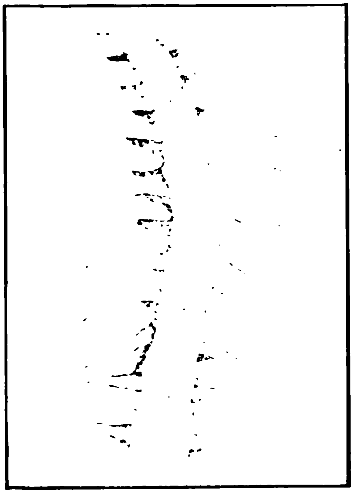


FIG. 31*a*.

FIG. 31.—Effect of tilting the pelvis when spine is flexed.

FIG. 31*a*.—Model placed in a plaster corset and held until the deformity has become fixed—single curve.

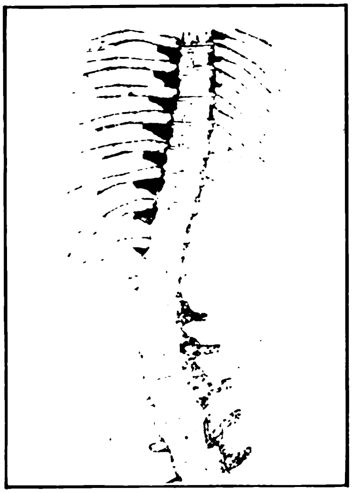


FIG. 31*b*.—Model placed in a plaster corset and held until the deformity has become fixed—double curve.

the same time the muscles on the opposite side have their point of fixation below and pull the ribs downward and forward, aiding this twisting of the spine.

The same observation leads one to believe that the lumbar spine is controlled in the same manner by the pelvis.

This position which at first is active, *i.e.*, due to muscular effort, soon becomes passive and habitual assumption of it seems to develop a typical scoliosis.

In these last experiments for proving the effect of muscular action upon the spine, all methods of arriving at final conclusions have not been exhausted, and the subject demands still further consideration before absolute statements should be made.

Note.—The illustrations showing the different positions of the spine by the X-rays are photographs of tracings and drawings made by an artist from skiagrams exhibited at the meeting of the American Orthopedic Association at Washington.

III.

CORRECTIVE JACKETS IN THE TREATMENT OF STRUCTURAL SCOLIOSIS WITH ESPECIAL REFERENCE TO MENSURATION AND RECORD.*

BY ALBERT H. FREIBERG, M. D., CINCINNATI, OHIO.

In 1912, I proposed a method for the forcible correction of structural scoliosis by means of plaster jackets, in the hope that it would constitute an improvement upon preëxisting methods. In common with them it sought to accomplish the correction by the application of force directly to those elements of deformity externally apparent. I was at the time unaware of the publications of E. G. Abbott on this subject. As the result of the discussion of this matter at the 1912 meeting of the American Orthopedic Association it was apparent that in Abbott's method there was utilized a principle radically different, in that force was applied, not with the object of achieving the correction directly. According to Abbott, scoliosis is acquired in the flexed position of the spine. Even though it was not done designedly, previous effort through forcible jackets was always blocked by bringing about the position of extension of the spine. Patients were either suspended by the head or were placed in the prone position on some yielding support. In either case the spine was extended and thus effectively locked against the reversal of the torsion element, without which no true correction could be attained. With the spine flexed, the application of force in moderate degree is sufficient, if properly utilized, to bring about a reversal of the elements of deformity and an overcorrection may thus be obtained and maintained and a cure brought about by

* Read before the American Orthopedic Association, May, 1913.

functional methods more or less akin to those employed in the case of other deformities, such as club-foot.

The method proposed in my paper was employed in a few cases only. I am able to say, at this time, that the final results in these cases have not been greatly superior to those previously obtained.

Careful reading of Abbott's publications and personal observation of his work made it apparent:

1. That in a large part of the cases a *cure* is to be sought and not simply an improvement.

2. That, as in the case of club-foot, the essential requirement is the attainment of decided overcorrection, especially in respect to torsion deformity.

3. That to imitate Abbott's work, a new technic must be mastered requiring great attention to detail.

4. That the technic is admittedly not yet perfected but open to substantial elaboration.

5. That before drawing conclusions as to the value of this method one must succeed in following Abbott's technic with fidelity and without making personal modifications of any important step until the original method has been mastered.

6. Finally, that it is not rational to expect Abbott's final results unless one has succeeded in attaining the primary effect demanded, namely: An actual reversal of the deformity to the opposite side both as regards lateral deviation and torsion of spine and chest wall. It must furthermore be clear that for the proper evaluation of any method of treating structural scoliosis we must distinguish carefully between the primary result or overcorrection of the deformity and the end result; the condition in which the patient is found some time after all retentive apparatus has been discarded.

Assuming that an overcorrection is possible of accomplishment, its value must lie in bringing about those transformations of bone structure which are admittedly necessary if a cure is to result. It remains to be shown how long a time is necessary to produce such transformations and whether we shall always be able to cultivate in these patients a musculature and thereby a posture sufficiently stable and persistent. It seems fair to say that we have here a postulate which must be fairly met, failing which, retrogression will surely occur.

My own experience with Abbott's method extends over a period of six months only and I am therefore not in position to speak of final results. The number of cases is, moreover, small since I have used the method in private practice only and upon such cases as I considered favorable and to which I could devote the utmost attention to details. I have without exception used great care in getting accurate record of the deformity before and after correction was made. This record was made by carefully marking each spinous process with a skin pencil and making a photograph of the back in both standing and forward bending positions. After this a graphic record of the deviation of the spine from the perpendicular was made according to the method which I demonstrated to this society on a former occasion. This record embraced the spine from the first dorsal vertebra to the gluteal fold and was drawn to a scale of 50 cm. with the aid of a slide rule. Record of the torsion deformity was made, in degrees, by means of a theodolite and this instrument was also used to measure the inclination of the line joining the acromion processes and the anterior iliac spines respectively. As the result of the painstaking use of these two methods simultaneously, I am brought again to the opinion which I have long held, that while the photograph is much more convincing to the lay eye and while it gives, undeniably, the better general impression of the figure, the graphic record is more accurate and distinctly more useful to the surgeon. It has furnished me with a more definite guide in the correction of the lateral deviation of the spine, especially since it shows this clearly in its relation to the displacement of the trunk upon the pelvis. If it has been encouraging in showing that a true reversal of the deformity has been accomplished in some cases, it has also demonstrated again that correction or even overcorrection of the figure may be apparent in the photograph, whereas the bony deformity has been influenced to a much less degree. This means simply that the apparent correction has been produced by yielding of the spine above or below the apex of the curve, or in both of these places. To my mind the demonstration of this fact is exceedingly important in its bearing upon the ultimate outcome of our cases.

Since the process of cure, according to Abbott's reasoning is to be a functional transformation of the bone structure, it would not seem reasonable to expect it to occur as the result of maintaining the corrected position for a few weeks only. Consequently, in all of the cases considered in this paper, the jacket has been allowed to remain not less than four months after maximum correction has been secured. It appears very significant to me that in two of my cases it was possible to secure an unusualy great overcorrection of the figure in the jacket and maintain this for five months without influencing the abnormal deviation of the spine to a marked degree. This could be observed by palpating the spine through the window in the jacket and we were, therefore, not surprised by what we found when the jacket was removed. With the spine flexed we had succeeded in bending the trunk far over toward the formerly concave side by the yielding of the spine above and below the deformity proper. In doing this, however, we displaced the curvature proper without greatly modifying it and the accommodative effect of this new position was not enough to produce the obliteration of the curve in several months time. While I cannot know how badly my technic would suffer under the personal criticism of its inventor and while I readily acknowledge my inexperience with the method, I am at the same time unable to perceive how I could bring about a different result in these cases because of the difference in resistance offered by the proper segment of deformity and those portions of the spine immediately above and below it. That it is possible to accomplish a reversal of all of the elements of deformity by this method seems beyond doubt. I have myself succeeded in doing this several times and Case I is an example of this. There is little doubt in my mind, on the other hand, that there are many cases in which we shall fail, under the present technic in achieving the overcorrection. Such failure may be attributed to several causes. I prefer to urge as the first cause, incomplete mastery of the technic. Aside from this, however, there would appear two other groups of causes which must be considered. One such group would comprise those structural scolioses in which a primary disease or malformation of bone is the etiological factor. Thus scoliosis resulting from rachitic disease with its subsequent osteo sclerosis, empyematic scoliosis and congenital scoliosis dependent upon asymmetrical formation of vertebral segments, obviously belong in a category separate from that usual developmental variety which we believe to be unassociated with any of these conditions. I believe that the explanation of a third group of difficulties is to be sought in certain characteristics of purely mechanical nature. For curvatures of the upper end of the dorsal segment, involving possibly the cervical spine also, and for the lower part of the lumbar segment, it appears to me that Abbott's technic must be amplified in order to secure effective mechanical control. For purely mechanical reasons, moreover, it will be obvious that curves of shorter radius will be more resistant in themselves. With such curves, on the other hand, the lengths of the comparatively normal segments above and below the curvature are disproportionately great; these more flexible segments will yield sooner to the corrective force which may thus carry the segment of deformity proper with it and in itself but little changed. To my mind this is what happens when overcorrection of the figure results without a corresponding overcorrection of torsion and bend in the spine itself. While this was apparent to me at the time of applying jackets, it was my hope that the apex of deformity would yield in course of time by reason of the change in functional stresses brought about by Abbott's position. While I do believe that this has occurred to some extent, it has not been realized to a degree justifying me in speaking of correction or overcorrection at the end of five months retention in such position. It appears probable to me that in such cases we should reapply the jacket and strive for further correction.

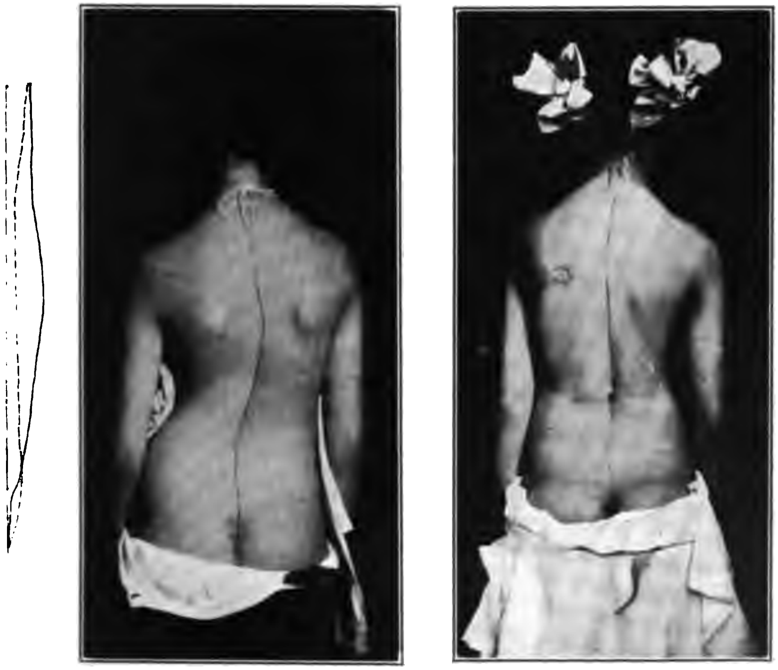
In studying my cases with a view to ascertaining what has been the effect of my corrective procedures, I have found it most useful to superimpose graphic records of the lateral deviation which have been brought to scale of 50 cm. and transferred to translucent cross-section paper. The records which are herewith presented represent such superimposed curves. The solid curved line represents the lateral deviation before the application of the corrective jacket and the broken line represents the lateral deviation immediately after the removal of the corrective jacket. Both curves are, therefore, drawn from the lower end of a perpendicular 50 cm. in length. The lower end of this perpendicular represents the top of the fold of the nates. Its upper extremity corresponds to the first dorsal vertebra.

The use of translucent cross-section paper makes it possible to compare the condition of the spine as shown on two or more records in a very convenient manner. By clamping them together at the top and bottom in such a way that the upper and lower extremities of the perpendicular line coincide exactly and holding the records up to the light, we are then able to compare the curves without the necessity of reconstructing them.

I shall add the account of five cases, in some detail, for the purpose of illustrating different conditions which I have encountered.

CASE I.—Girl, fourteen years old and tall for her age. Postural asymmetry observed for about two years. Sight of left eye very defective. Right convex dorsolumbar scoliosis. Torsion 13 degrees to the right. Jacket applied Oct. 14, 1912. Jacket removed March 17, 1913. Examination now shows the reversal of the curve. Displacement of the trunk on the pelvis still exists because of sharp bend in the sacrolumbar region which has not been overcome. Torsion of the chest has changed from 13 degrees right to 8 degrees left. While not a difficult case, this one demonstrates the possibility of reversing the deformity in all of its elements.

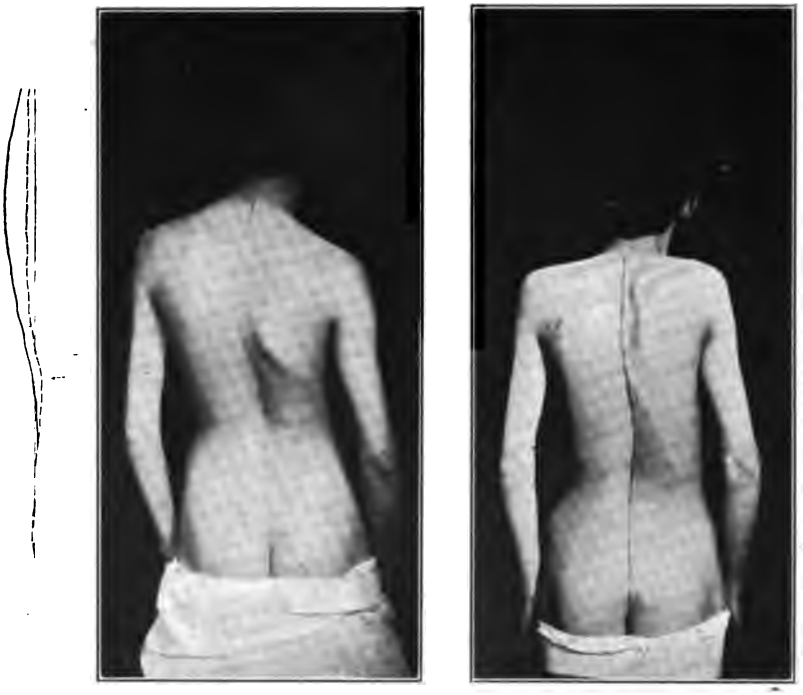
CASE II.—Boy, seventeen years of age, badly nourished and very myopic. Marked high dorsal (cervicodorsal) left convex structural scoliosis. Supposed duration, one year. Torsion 9 degrees left dorsal, left acromion 7 degrees high. Maximum deviation 5.2 per cent. to the left. Overcorrection apparently satisfactory in the jacket. Jacket removed March, 1913. Now has maximum deviation of 1.4 per cent. to the left in the dorsal and of 1.2 per cent. in right lumbar region. Torsion 7 degrees left dorsal and 2 degrees right lumbar. Right acromion 3 degrees high. I feel that this case demonstrated the insufficiency of this technic for the highest part of the dorsal segment.



Case I.—Reversal of both dorsal and lumbar curves. Trunk still displaced to the right because of the sharp kink in the lumbosacral region.

While the amount of lateral deviation of the spine has been greatly diminished (about 50 per cent.) and the figure much improved, there has been no true overcorrection. On the contrary a part of the improvement in the dorsal curve has apparently been obtained by producing a lumbar compensation. This case might be further improved by another jacket.

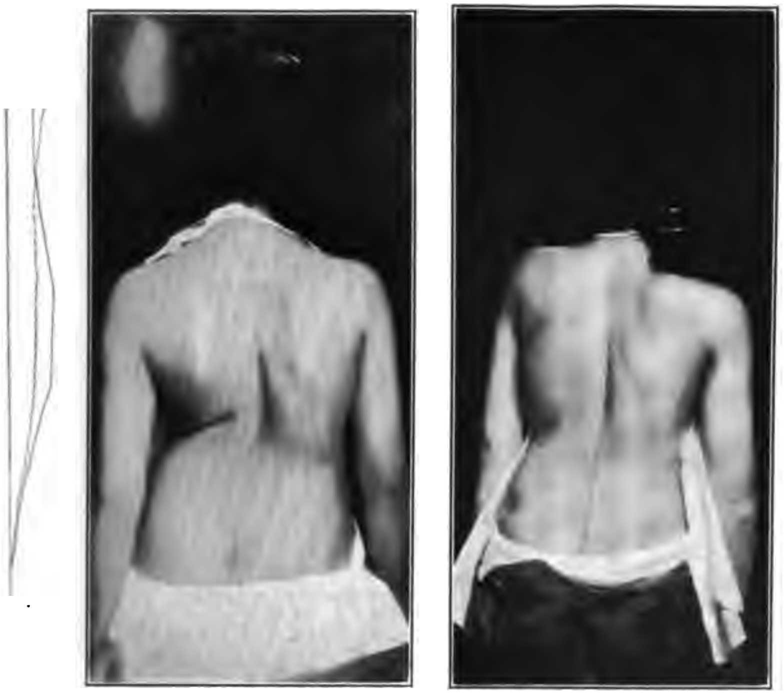
Case III.—Girl of fifteen years, large for her age and heavy set. Marked right dorsolumbar scoliosis. Has been under treatment for two years by means of jackets applied in prone position and by gymnastics. Lower extremities of equal length but X-ray shows decided obliquity of the sacrum which is apparently congenital. Maximum deviation 9.4 per cent. right, displacement at first dorsal vertebra 6 per cent. to right. Torsion deformity 18 degrees right dorsal. Abbott jacket applied in October, 1912. After four weeks it was apparent that the lateral deviation was not corrected. The jacket was cut away over the right hip and the pelvis set over. Correction was not satisfactory, however. Upon removal of the jacket in March, 1913, maximum deviation was reduced to 6.2 per cent. right, displacement from the perpendicular at first dorsal vertebra increased to 8 per cent. Torsion of right lower chest apparently 0°. I feel that this has been the least satisfactory result in all of the cases treated by the Abbott jacket and at this



CASE II.—Diminution of the dorsal curve but not complete correction. Displacement of the truuk diminished by bend in lumbosacral region.

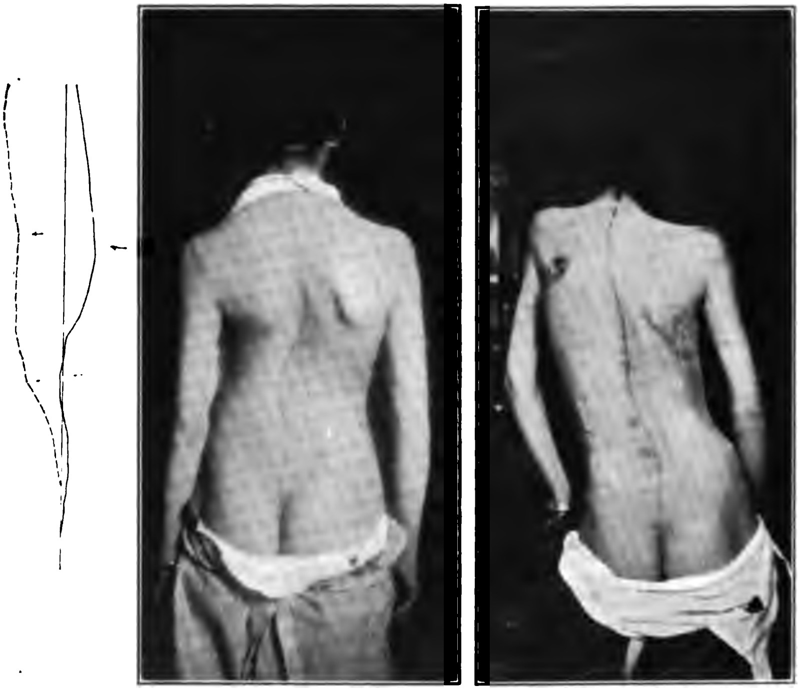
writing it is apparent to me that the improvement of the figure will not be maintained without the continued use of support.

Case IV.—Girl of thirteen years, tall for her age and slender. Structural scoliosis; right dorsoconvex deviation 6.4 per cent. maximum; left upper lumbar deviation 0.4 per cent., right lower lumbar deviation 1 per cent. Torsion 9 degrees right dorsal, 8 degrees left lumbar. Displacement 2 per cent. to the right at first dorsal vertebra.



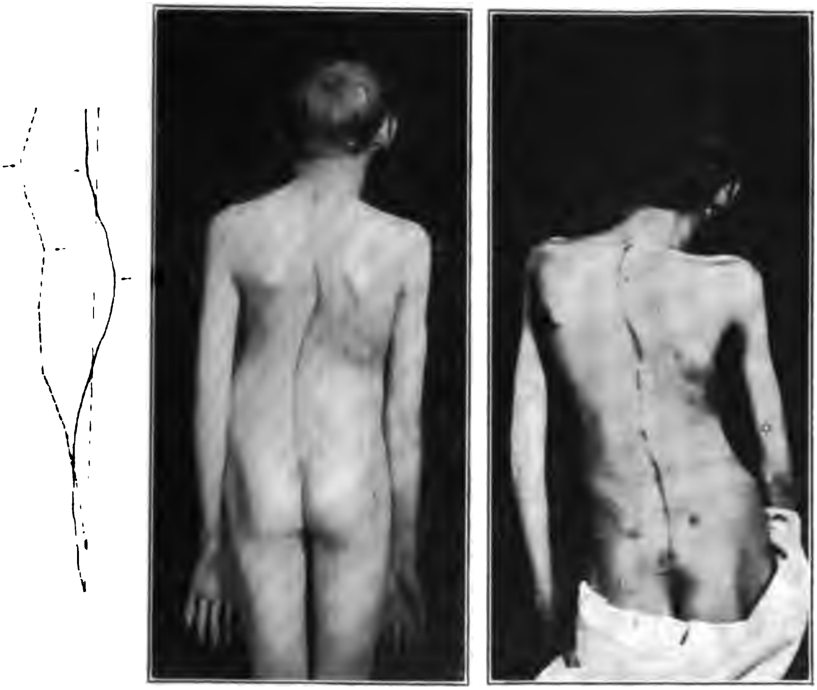
Case III.—But little real improvement of the condition. Apparent improvement produced by an increase of trunk displacement.

Jacket applied October 30, 1912. Marked overcorrection of dorsal deformity apparently in the jacket. Lumbar deformity not entirely corrected but hips were not set over as I hoped for spontaneous correction by compensation. Jacket was removed March 21, 1913 and the figure was greatly overcorrected. This is, however, not true of the spine itself as seen on the record. Torsion deformity of the dorsal region has been reduced to 0° but has not been reversed; torsion of the left lumbar region remains unchanged at 8 degrees. Displacement of the trunk has been greatly changed; from 2 per cent. to the right, at the first dorsal vertebra, we now find it 12.2 per cent. to the left at this same level. A glance at the superimposed curves will show that this has been brought about by a great increase in the bend to the right of the lowest lumbar segment. In consequence of this the left upper lumbar deviation has been displaced far to the left without being greatly changed intrinsically. While this case has been greatly improved I doubt the efficacy of setting over the hips since it would seem impossible to accomplish this without still further increasing the bend to the right in the sacrolumbar segment.



Case IV.—Apparent overcorrection. The dorsal curve is improved but not completely corrected. The lumbar curve is but little changed. Very great reversal of trunk displacement produced by sharp bend in the lumbosacral region.

Case V.—Boy, ten years of age. Marked structural scoliosis. Left convex in the high dorsal region, right convex in the middle dorsal and left convex in the dorsolumbar region. The deformity has been noticed since childhood. There are no stigmata of rickets. The X-ray fails to show any numerical variation or decided arrest of development. Nevertheless I consider it not impossible that this is a congenital scoliosis. Torsion deformity 3 degrees left high dorsal 25 degress right dorsal. Pelvis 5 degrees high on the right side and the measurement of the lower extremities shows the right limb to be 3/4 inch longer than the left. Displacement at the level of the first dorsal vertebra 4 per cent. to the left. An Abbott jacket was applied October, 1912 and was removed April 16, 1913. Torsion deformity is now 12 degrees to the left of high dorsal region and 12 degrees to the right lower dorsal region. The trunk has been displaced far to the left and there is very great overcorrection of the figure. The displacement at the first



Case V.—Great displacement of the trunk without considerable change in the essential deformity. The lower lumbar region has been the seat of greatest change.

dorsal vertebra now amounts to 12 per cent. to the left. By examination of the curves superimposed it is seen that the greater amount of correction has been produced by reversing the left convex curve in the lumbar region and producing a rather abrupt bend in the sacrolumbar region together with an increase of the left convex deviation in the uppermost part of the dorsal spine. An examination of the superimposed curves shows that the curve to the right in the middle dorsal region has been carried over to the left by the overcorrection of the figure without having undergone any considerable change intrinsically.

In addition to the five cases above reported, I wish to speak of a sixth whose jacket is still in place, three months after its application. The patient is an undersized, heavy set girl of thirteen years with a clear history of rickets in infancy and with rachitic stigmata plainly recognizable. She has a very marked dextroconvex dorsal and sinistroconvex lumbar scoliosis. Torsion deformity is considerable, amounting to 20 degrees in both dorsal and lumbar regions. She has been treated for several years by means of jackets, in other hands than mine and is one of those whom I treated by the method reported last year. An Abbott jacket was applied to her Nov. 21, 1912. Although I believe there has been more correction resulting from this last jacket than from the others which I had applied to her, she is still far from being corrected at the present time. This is in spite of energetic effort on my part and it seems to me impossible that an overcorrection could be secured in this case by any technic which is now at our command.

I have come to the following conclusions as the result of my experience with Abbott's method.

1. It is surely possible to secure the reversal of the elements of deformity in some of the cases of structural deformity by Abbott's method.

2. It appears that in quite a number of cases our means of correction cannot be exhausted in one jacket. It is probably better to remove the original jacket at the end of six weeks to ascertain what further needs to be done and what can be done.

3. It is my conviction that this method of applying corrective jackets constitutes a great advance and that the correction

which we do secure is much greater than we have obtained by former methods. Whatever discomfort is involved is usually justified by increased efficiency.

I am anxious that these statements should be recorded simply as an expression of my own experience and that I do not feel that the method should be condemned on this account. On the contrary I am too conscious of the shortcomings of my technic, of the short experience which I have had with so complicated a method. I must simply insist that I have tried faithfully to follow the details of the method as they have been laid down and as I have seen them carried out. I have not hesitated to make my patients exceedingly uncomfortable although this has been for short periods of time. I have left my jackets in place long enough for the transformations to take place. I shall continue to strive with this method in the hope that I may become increasingly successful in its application and that with mastery of the details there may come the means of perfecting its technic and adding to the expedients at our disposal.

IV.

SCOLIOSIS, ITS PROGNOSIS.*

BY JOHN L. PORTER, M. D., CHICAGO.

There are so many factors to be weighed and considered in estimating the prognosis in scoliosis that in many cases it is difficult to make any very definite statement as to the probable result of treatment. We are not only unable to forecast just what degree of improvement we can secure by *any* method of treatment but we are unable to tell definitely which cases will remain stationary without treatment, and which ones will grow worse in spite of treatment. Surprises have been so frequent in my own experience that I now limit my prognosis to stating what I hope may be accomplished by treatment, telling the patient frankly that improvement is the rule, and that in a certain percentage of cases cures are possible, but that I cannot tell beforehand whether a cure or only improvement is possbile.

There are, however, certain general factors which have a bearing upon prognosis which should be considered.

1. *The Cause of the Deformity.*—The underlying cause, where it can be determined, should probably be given as much weight in estimating the chances of improvement as any other factor, perhaps more.

Undoubtedly cases due to defects in spinal development with imperfect vertebræ and deficient ribs offer the least hope of any of improvement, and then retentive apparatus must be worn continuously to prevent the deformity from growing worse.

Cases following rachitis which have gone on through childhood without treatment, those resulting from empyema with pleural adhesions, and paralytic cases, all offer a bad prognosis as regards complete correction.

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* Read before the American Orthopedic Association, May, 1913.

Next come those cases due to static errors as unequal length of legs, unequally developed pelves, vicious habits of sitting in school, etc. Cases due to torticollis, visual and aural defects, elevated scapulæ, etc., should be corrected when the cause is abolished if the patient has not reached adult life, and the vertebræ become hard and fixed.

The most hopeful class comprises those cases·in which no definite cause can be found, and we must assume some inequality of strength or development of some muscle groups concerned in holding the spine erect, either spinal, thoracic, or abdominal.

2. *Age at Onset.*—Generally speaking, the earlier the deformity develops, if it goes on for several years without treatment, the worse the prognosis, but where a developing deformity in young children is detected early and given prompt treatment, we should naturally expect excellent and speedy results, in cases not due to congenital bony defects. This expectation, however, is not always fulfilled. I have one case three years of age with no bony abnormality in which I expected to secure complete correction in two months, which to-day, after a year of constant treatment, is little if any better than when I began. And I have wondered if the very flexibility of the ribs may not militate against success by permitting them to bend under treatment without affecting the rotation of the vertebræ.

3. *Age of the Patient.*—Next to the etiology the patient's age when treatment is begun is probably the most important factor in prognosis. Naturally, if there is a fairly long peroid of growth and development ahead during which treatment can be carried out the greater the chance for improvement. I think we have all found our greatest success, in the ordinary cases of double curves with moderate rotation, between the ages of twelve and twenty years. Here again, however, exceptions to the general rule may be startling. One of the greatest surprises in my own experience was with a patient of thirty-eight. She had a severe rotary deformity of the dorsal spine with compensatory lumbar curve which had been growing steadily worse

since early girlhood. She could not walk half a mile without pain and distress, and during every menstruation she was an invalid. After four months treatment she is to-day so straight that only a trained eye can detect any deformity, is taking long walks in the mountains, and menstruates normally.

Increase of the deformity in patients past middle life which has remained *in statu quo* for years is sometimes seen and is doubtless due to trophic changes in the bones or joints. Such cases can only hope for relief by permanent retentive jackets.

4. *Type of Deformity.*—Lovett has truly said that simple total curves in growing patients *should* be completely cured but we all know that not all are cured. In fact we have all seen cases which seemed to be due to some static error and which we expected to cure by education, exercises, and leveling the pelvis, go on to double rotary deformity in spite of treatment. Undoubtedly many slight cases of single or even double curve early reach a fixed point and go on through life without increase of deformity, and these cases probably furnish a fair percentage of the number which, under treatment, show such excellent results.

To sum up the question of type in one sentence, the fewer the curves and the less the rotation the better the prognosis, providing they are below the cervicodorsal region.

5. *The Patient.*—Under this heading must be considered all personal factors such as temperament, occupation, intelligence, general health, etc., which may complicate or effect treatment in any way. We all know what a help it is to deal with an optimistic, alert, interested patient who is anxious to help, and how hard we have to work to secure any encouragement in phlegmatic or depressed, weak-willed and flabby-muscled subjects.

Any type of deformity in a rapidly growing girl with no ambition and poor digestion, who would rather curl up in a big chair with a box of candy and read all day than get out and exercise is almost sure to grow worse. An occupation which necessitates the patient's working ten hours a day with one shoulder elevated and body bent sidewise, or standing with the weight all on one leg while the other is elevated, will of course interfere with any treatment.

Obesity would seem to be, and I believe is, a condition which weighs against rather than for success, and yet (another surprise) I have a girl of fifteen under observation, a light-haired phlegmatic blond, who weighed 180 pounds, with a marked double curve, and decided dorsal rotation who is now straight after one Abbott's jacket and who has so far (two months after removal) shown no sign of needing any retentive apparatus.

6. *Incidental Benefit of Treatment.*—In summing up our prognosis we must not forget that not all the benefit of treatment is evidenced in the back or spine. Low general health, depression, poor digestion, functional derangements of circulation often improve with improvement of the scoliosis. This has been particularly impressed upon me in a thin, sensitive young woman of twenty-four with a severe rotary deformity, who also had exophthalmos, a rapid pulse, and was so depressed and miserable, and discouraged that she rarely smiled. Fortunately, she has improved and with that improvement has come a total change. She is cheerful, better nourished, fills an active clerical position with interest, and much to the surprise of all, her exophthalmos has decreased very noticeably.

V.

A CONSIDERATION OF THE CORRECTION OF THE FIXED TYPES OF LATERAL CURVATURE, COMPLICATED BY VISCERAL DERANGEMENTS, ESPECIALLY THOSE OF THE CARDIAC VARIETY, WITH A SLIGHT MODIFICATION OF ABBOTT'S METHOD.

BY ROLAND O. MEISENBACH, M. D., BUFFALO, N. Y.

It seems from the recent activity in the treatment of lateral curvature of the fixed type that a new era has been established as regards the treatment of the severer types of lateral curvature with rotation and distortion. Formerly it was considered that in cases of lateral curvature with severe rotation, and sometimes even in those of a minor degree, the correction was impossible. In these severe cases the only accomplishment was to hold rather than to correct.

To-day, however, matters stand differently as regards these cases. Most of this is due to Dr. Abbott's thorough work in developing a new theory, with results that heretofore have been unthought of. However, it is not alone due to Abbott's work that the new era has been brought about, giving to the world a better understanding of these heretofore considered incurable cases of lateral curvature, but also to Bradford, Lovett and Schulthess, and many others, who during the past years have so unceasingly brought forth research work in connection with all the phases of lateral curvature.

The actual correction of the spine is only a portion of the consideration of this paper. I have been convinced from actual work done in cases that heretofore would not yield to any method, that the spine can be actually rotated, straightened and the distortion of the ribs corrected. This may be true in a greater or less degree, depending upon many conditions. Therefore, the problems which are presented to the orthopedic surgeon today in connection with these cases are many, and deserve the earnest consideration, not only of the orthopedist, but of the internist, pathologist and chemist. The old maxim that cases with rotation cannot be helped or corrected (so often used by the general practitioner) is at present considered incorrect. Nevertheless, there are still many sceptical medical men who are apt to follow the same teaching as formerly, and in consequence, the individual is, as of old, often neglected or convinced that his condition cannot be improved. There may be many reasons for this scepticism on the part of the internist, as, for instance, he may concede that the spine can be corrected, but that if corrected the patient will be subject to extreme dangers from the disarranging of the viscera, or that the nervous shock may be too great. The viewpoint must be wide and the problem studied from all sides.

The object of this paper is to bring forward some observations that have occurred to me while treating the different types of scoliosis. It is more of a practical one, but nevertheless, very important. One of the severest criticisms of the work of Abbott has been the question of dicomfort to the patient, or the possible danger and risk which the individual must undergo in accepting the newer methods of treatment. If we more thoroughly understand the rearranging of the spine and viscera we will be in a better position to select the cases, with less risk and more comfort to the patient. There is no question in my mind that the fixed types of lateral curvature, whether in a mild or a severe degree, can be respectively straightened or improved. However, it is not the object of this small part of the symposium to present the correction of lateral curvature so much as it is to present the far-reaching effects of the correction of rotation on the viscera and general functions of the body; and also to consider whether or not to undertake certain of the severer forms for treatment in which pathological changes other than bony are marked and alarming.

The individuals with lateral curvature of the fixed severe type are usually below the normal physically. The reason for this is selfevident. The nervous irritability and lack of resistance are the very common symptoms. It is a well-known fact that most cases of lateral curvature necessarily have secondary changes in other parts of the body. Whether they are functional or organic is a matter of the particular case. The relation of disease in general to scoliosis is well brought out in statistics which have been collected by Thorndike and given in his work, from which I will freely draw. Under "Lungs" he says:

Bachman found from records of 182 autopsies on scoliotics that many have consumption, and many die of it, 28.3 per cent. of the severe cases and 66 per cent. of the milder ones. The chest capacity is diminished most in the convex side, when there is a marked rib hump. Clinical corroboration of this fact is furnished by Mosse, who noted apex infiltration in 60.2 per cent. of scoliotic children; and by Caminel and Zade, who found it in 73 per cent. of scoliotic women. Adhesive pleurisy was found in 74.6 per cent. of Bachman's autopsies; in 31 per cent. there was atelectasis of lungs, and in 23 per cent. pneumonia. Under "Heart" he further says: The heart usually displaced upward and crowded to the front, is often enlarged both by hypertrophy and dilatation; the right heart was affected in 66 per cent., the left in 17.5 per cent., and both left and right in 25.9 per cent. The aorta and the great veins are not much distorted, but occasionally run an unusual course. The esophagus also varies but little from its normal course, if the curve be a long one.

I wish to add here that it has been the experience of the writer, observing the radiographs of the heart, that symptoms occur from two causes: The tachycardic symptoms are usually due to the pressure of the ribs upon the pericardial sac, and the heart is displaced downward. Quoting Thorndike on Abdominal Viscera, he again says: The Diaphragm is pushed up high, and, of course, follows the inclination of the thorax. The abdominal viscera are in consequence of decreased space, crowded downward and forward and the small intestines occupy the cavity of the pelvis; the transverse colon may take an almost vertical course if there is much displacement of the trunk to the right. The liver, in right curvatures, is crowded over to the left and the left lobe has a better chance to grow large. The right kidney, in right curves, is displaced up, and the left down; the latter is often the seat of pathological change; out of 180 observations, Bachman found fourteen

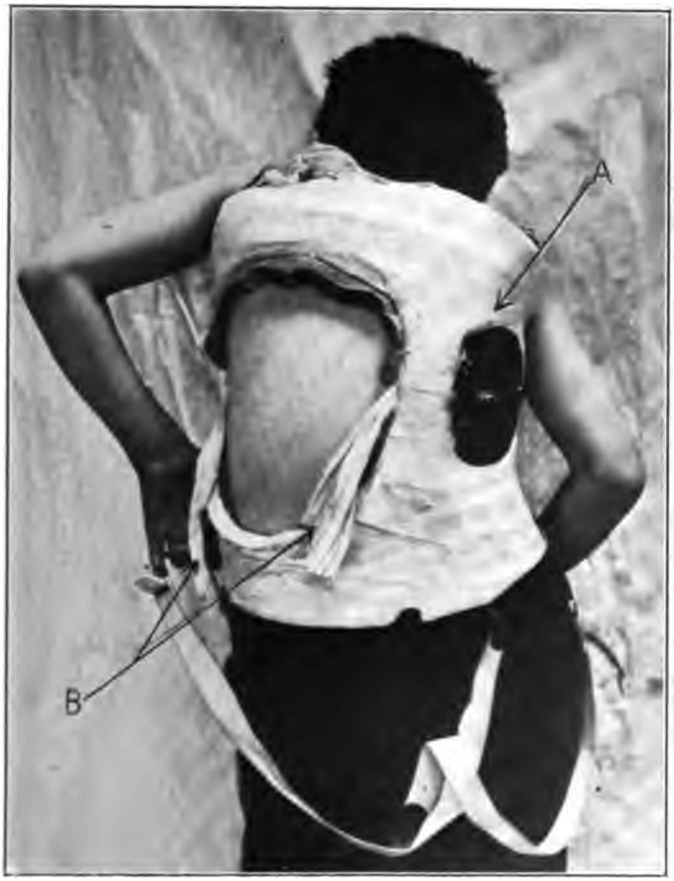

FIG. 1.—(A) steel trap door inserted into jacket in order to use gradual forcible correction after the jacket has been applied. (B) Streamers used to insert anterior pad.

cystic kidneys, thirty-one with granular atrophy, eighteen with simple atrophy and six hydronephrosis.

The spleen may be displaced upward; perisplenitis, atrophied and cyanotic indurations have been observed. The stomach, owing to the crowding downward and forward of the liver, and with it of the duodenum, has a more vertical direction from the cardia to the pylorus. It seems to me that in dealing with the fixed types of lateral curvature one must take into consideration the types of the spine to be considered; namely, those rigid, in which flexion is not voluntary, although there is a marked degree of rotation; and on the other hand, the flexible, in which voluntary forward flexion is obtained. Since some of us are attempting to correct these fixed types, it is necessary to consider the viscera more than formerly, because then rotation had not been actually accomplished and the viscera, as for instance, the heart not disturbed. The sharpness of the curve, a compound or an acute total, are of importance in these two types. As a rule, the rigid type will yield to correction more easily, but the systemic shock is greater. On the other hand, the flexible stand the correction better, but do not yield as quickly. The symptoms, due to pressure of the spine, together with the ligamentous stretching and the decrease in-cavity space are well known, but must be considered so that we may not be led astray.

Even changes in the blood may be indirectly due to spinal curvature, as is evident in one case that came under my observation. Digestive symptoms are frequent, as are also vasomotor disturbances. Tachycardia is frequent, but usually more pronounced in the advanced cases. Albuminurea is absent in the majority of cases. The Von Pirquet for tuberculosis may be present frequently, and it immediately brings up the question whether the cause of the reaction is primary or secondary to the curve. It is the author's opinion that little importance should be attached to the reaction when present in lateral curvature when the X-ray shows a lung focus with a clear spine. However, there are exceptions to this rule. Hemoglobin usually is below normal; vomiting and pain may be present, due to the curvature. As we have seen from Thorndike, heart lesions are frequent and it is also the author's opinion that they may be due to pressure caused by the rotation of the spine, and that they do not generally interfere with the correction. The blood pressure varies but one or two millimeters of mercury, and in some cases not at all.

At the application of each jacket, blood pressures are made before, during and after the corrective jacket has been applied, and six of the records are as follows:

BLOOD PRESSURE

	Before application of corrective jacket	During application of corrective jacket	After application of corrective jacket
1	122	122	123
2	115	115	114
3	118	118	118
4	138	138	133
5	130	128	128
6	124	122	118

Three cases may be of interest, which illustrate the beneficial aspect of spinal correction very graphically:

A girl, twenty-one years old, with an average fixed total dorsal spine, with a history of indigestion and frequent vomiting, with functional heart murmur (Dr. Mendlein) was overcorrected in seven days. Two months have elapsed since treatment. Color and appearance of girl markedly improved; digestive disturbances have not been mentioned by patient since; whereas, before her weight could not be increased, now she is rapidly gaining. This was undoubtedly a case of visceral ptosis which has corrected itself with the correction of the spine. (Blood pressure No. 5, table above.)

A girl, seventeen years old, total sharp curve, with angular deformity of the ribs, with the shadow of heart outside of the spine; aortic stenosis present (Dr. Wagner); had been warned against any active exercises; spine brought almost to median line. Blood pressure before correction 122, during correction

122, after correction 123. General health has improved, heart murmur less distinctly heard.

A girl of sixteen, with a total dorsal curve, pale and anæmic; history of vomiting last four or five years; very nervous. Hemoglobin 50 (Dr. Rochester). Curve brought almost to median line in about six weeks. After three weeks, hemoglobin jumped to 65, a little later to 70. Patient has not vomited; has comparatively little pain. Is growing fleshy and color good.

The few cases cited illustrate very nicely the quick benefit that may be offered individuals with spinal curvature, and the far-reaching results that may be obtained; as in the case of the hemoglobin, one would hardly have expected that it would rise so quickly. I have followed out carefully Abbott's technic, but have modified it slightly, and in those cases in which it was questionable whether to attempt the procedure of correction or not; as, for instance, in the case of aortic stenosis, fully appreciating my responsibility, I naturally used less pressure at the time of first correction than I should in an ordinary case. However, keeping Abbott's cardinal principle ever before me, that is, to thoroughly flex the spine in applying the jacket, I added somewhat more felt than ordinarily to the posterior part of the spine, with the hope of obtaining more flexion and gradual pressure later on. To obtain this, a window is also cut over the point of most pressure, and a steel trap door so arranged that additional felt may be added at will and pressure applied with a wrench. This has permitted four or five thicknesses of felt, whereas one or two only could have been used by the other method of attempting to add felt to the window (see Fig. 1). The pressure then can be gradually added and correction obtained some weeks after the corrective jacket has been applied. By this method, the pulse and blood pressure can be thoroughly followed, and if there is too much pressure, less be applied. It also has the advantage that in cases of sloughs they can be dressed and the pads so arranged as to avoid pressure over them.

In conclusion, I wish to emphasize several facts:

First: That it is surprising to see how small a change of blood pressure takes place when the rotary force and flexion are applied.

Second: That cases troubled by ptosis and gastric symptoms may improve in general health with a disappearance of symptoms after the spine has been corrected.

Third: That the hemoglobin may often increase its percentage after the spine has been corrected, and without medication.

Fourth: That it should not be the rule to attempt to build patients up by medication, and thereby lose time in spinal correction, but that after the spine is corrected, these measures may be undertaken with better success.

Fifth: Cardiac lesions, especially functional due to pressure, may improve after correction, and are not increased.

Sixth: In cases of the severest types with great deformity of spine and derangement of viscera, treatment should be undertaken cautiously, with a view of improving the general condition of the patient.

VI.

THE HISTORY OF SCOLIOSIS.*

BY ROBERT W. LOVETT, M. D., BOSTON.

To write the history of scoliosis one must start with the beginnings of medicine and follow down through some 2500 years the course of an affection for many centuries classed with other curvatures of the spine, and considered, as they were considered, due to dislocation of the vertebræ. One finds in this, as in most affections long recognized, that time brings about its identification as an entity, and it gradually becomes separated from similar affections and is discussed by itself.

Now the presentation of the information thus obtained may be made in two ways First, one may present a systematic and thorough account of the status at different periods in medical history, and show how one step led to another in the evolution of our knowledge. But in the case of scoliosis this method is not perhaps the best, because it has already been admirably and thoroughly done by Fischer† and Chlumsky,‡ and because of the enormous mass of literature which has accumulated. Prior to 1870 Fischer had tabulated 380 articles, and in the résumé of modern orthopedic literature published by Hoffa and Blencke in 1905 there were 1020 titles given dealing with scoliosis. Hundreds of articles have appeared since 1905, and it is evident that the mass of literature is enormous.

The second method of presentation of such a subject would consist of a brief résumé of its evolution, with emphasis on what seemed to be the salient points, the real steps in progress, points which have improved our knowledge of etiology or the efficiency of our treatment. And so the second has been chosen as the most available for the present purpose.

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* Read by title before the American Orthopedic Association, May, 1913.

† Geschichte und Behandlung der seitlichen Rückgratsverkrümmung. Strassburg, 1885.

‡ Chlumsky. Prispézky k Déjinam Skoliosy. Prag, 1910.

One finds in the study of the origin of most pathological conditions that they are at first confused with other similar affections, gradually emerging and being identified, and in scoliosis this is particularly the case, all curvatures of the spine—forward, backward and sideways indiscriminately—being considered practically up to the eighteenth century as dislocations.

The term "scoliosis" dates much farther back than the recognition of the affection itself. σκολίοω, from which scoliosis is derived, is a Homeric word meaning to bend or twist, and the term σκολίωςις was first used by Hippocrates, who lived four centuries before the beginning of the Christian era. His use of the word apparently was to designate a lateral form of the spinal curve supposed to be due to dislocation, the forward curve being called lordosis and the backward curve kyphosis. There were two other words in use at this time which have dropped out, and which are of no significance.

Although the name scoliosis was given by Hippocrates, a very short extract from his works will show that he had little or no idea of what the condition was. After a description of posterior curvature of the spine, which is fairly accurate in a very rough way, he goes on—"In some cases the curvature of the spine is lateral, that is to say, either to the one side or to the other, and most of such cases are connected with tubercles (abscesses?) within the spine, and in some the position in which they had been accustomed to lie cooperates with the disease ....but these will be treated of among the common affections of the lungs."

"Lateral curvatures also occur, the approximate cause of which is the attitudes in which these people lie. These cases have the prognostics accordingly."

Yet Hippocrates gave a very clear description of club-foot, which was well recognized by him, and although the splints advised seem rather inefficient the treatment by moulding and retention was advocated. Patients with spinal curveos, however, were tied by the legs to a ladder, and the ladder raised and then dropped to the ground, striking on one end, thus tending to straighten the spine, or such patients were put into an apparatus to make extension and pressure on the prominence. He adds as a further refinement of his treatment, "It is also safe for a person to sit upon the hump while extension is being made, and raising himself to let himself fall down again upon the patient." He also suggests putting one foot on the hump or using a long wooden lever, but one finds no mention of any attempt at retention, and the reason for this is that all the treatment was based on the supposition that the affection was due to a dislocation, which demanded reduction only.

For about two thousand years after Hippocrates scoliosis attracted little attention and no advance was made, Paul of Aegina, 650 A. D., suggested bandaging to wooden strips in cases of curvature of all varieties, and Albukasis 500 years later announced that "no one could cure curvature to the side."

And so one comes down through the centuries with no new light to the time of Ambroise Paré, born in 1510, and we find him where we left Hippocrates 2000 years before. I quote from his writings: "A dislocated vertebra standing forth and making a bunch is termed in Greek kyphosis, but when it is depressed it is called lordosis, but when the same is luxated to the right or left side it maketh a scoliosis, which, wresting the spine, draws it into the similitude of the letter S . . . . Fluid and soft bodies, such as children, are very subject to generate this internal cause of defluxion. Thus nurses, while they too straitly lace the breasts and sides of girls so to make them slender, cause the breast bone to cast itself in forward or back or else the one shoulder to be bigger or fuller, the other more spare or lean. The same error is committed if they lay children frequently and long upon their sides, then upon their backs, or if in taking them up when they walk they take them only by the feet or legs and never put their other hand in their backs, never so much as thinking that children grow most toward their heads." Then follows a fair account of the deformity, and the reduction of the dislocation is on the same lines as advocated by Hippocrates, by extension and pressure by the hand or by lever. He suggested, however, the use of a padded iron corset, the illustrations of which are familiar to all of you, but still it was always a dislocation that was considered. It was to be treated by levers and great force, and the after-treatment played only a very small part.

Among the various authors of the next hundred years one finds silence on the subject in most, such as Fabricius, Hieronymus and Vesalius, but here and there are flashes of light, mostly fantastic speculations as to etiology, but the affection was frequent, for Riolan in 1641, stated that in France the girls carried as a rule the left shoulder higher than the right, and that one could hardly find a case where the shoulders were rightly constructed. His speculations as to etiology were much the same as those of the nineteenth century, namely, the use of the right arm and the wearing of stiffened corsets. The first autopsy of a scoliotic case was reported in 1646 by Fabricius Hildanus, without apparently clearing up the matter. Glisson, writing of rickets, which he named rachitis, in 1660, described the spinal curves due to it, and suggested for their indiscriminate treatment gymnastics or suspension, but Glisson's suspension was from axillæ, head and hands, by which the children were slung and allowed to play in the air, which he adds " they did with great enjoyment." The head sling proper dates from Nuckius in 1696, and was devised for the treatment of wry neck.

From this time until the time of André in 1741, I cannot see that any author contributed much to progress, although it is evident that whalebone corsets were coming into use as a method of treatment, originating with Jungken in 1691, and the mention of scoliosis is more frequent than in the preceding century, but never apparently differentiated clearly from other curvatures.

André was a man of originality, the inventor of the term "orthopedic," and he wrote more fully of spinal curves than his predecessors. He condemned high heels and blamed them and bad sitting positions for much of the faulty attitude. Among causes for spinal curves he mentioned hemorrhoids, which were so painful that the child could not sit squarely, and he called attention to the important fact that as a child grew the clothes must be made larger. He suggested gymnastics and apparatus as a means of treatment.

Taking it altogether the middle of the eighteenth century, that is to say, the time of the beginning of the American Revolution, was a time of considerable activity and some little progress in the history of scoliosis. André was the first to group deformities together and to give a name to the specialty. His directions about treatment were vague, but he recognized in bow legs at least that the same means must be taken to straighten them as were adopted to straighten the crooked stem of a young tree. He advocated friction of the deformed parts and their gradual restoration by manual extension, pressure and localized movement. A very distinct step at about this time was made by the classical work of Percival Pott, who published in 1779, his essay on "The Palsy of the Lower Limbs in Consequence of a Curvature of the Spine." In this work he took out of the unclassified group of affections known as curvatures of the spine those posterior curves caused by spinal tuberculosis. He stated with regard to the paralysis "that none of those strange twists and deviations which the majority of European women get in their shapes from the very absurd custom of dressing them in stays during their infancy, and which put them into all directions but the right, ever caused anything of this kind, however great the deformity might be." His description of spinal tuberculosis was so accurate that it immediately identified posterior curvature as a carious or scrofulous disease of bone and not as a dislocation, and thus cleared the field for the recognition of scoliosis as an entity.

About this time scoliosis was becoming more clearly defined. Autopsies were being performed, and it was being recognized that it was not to be classed and treated with the posterior curvatures. This came not only from the work of Pott, but was gradually coming in from all sides, and apparatus of various kinds began to be devised. The iron cross of Heister, invented in 1700, began to be displaced by apparatus more of the modern type, and the corset of Maguy, devised in 1762, would find a sale to-day in the instrument shops, but the greatest impetus was given by the apparatus of Levacher in 1768, which consisted of a whalebone corset to which was affixed a jury mast and a head sling.

Although the period at the middle of the eighteenth century, as has been said, was one of considerable activity and progress, in the development of scoliosis, at about this time there began and lasted for over a hundred years, the dreariest and most confusing period in the history of the affection. The theorist and the apparatus inventor went mad, and every form of device appeared. Braces and corsets infinitely complicated, worse than useless, appeared by the dozen. Beds especially constructed, chairs, slings, swathes, belts, levers and the like, all found their advocates, and theories as to the causation also ran riot, but on the whole the invention and elaboration of apparatus held the center of the stage, and one heard but little of gymnastics.

It is difficult to trace the origin of the gymnastic treatment of scoliosis, for it had existed from an early time. Even as early as Glisson a system of gymnastics was clearly formulated, and apparently gymnastic treatment was not at that time by any means new. Sydenham, 1624–1689, wrote "If any one knew of the values of friction and exercise and could keep his knowledge secret he might easily make a fortune," and "Fuller's Medicina Gymnastics," published in 1704, was followed by a similar work by Tissot in 1781, and by Jahn and others, who worked with energy to spread German gymnastics. A very decided impetus came from Sweden from Henry Ling, who died in 1839, and who founded a system of gymnastics known as the Ling system or Swedish movement treatment. An institute under the supervision of the Swedish government was established in Stockholm, and Ling was its first president. A paper advocating gymnastic treatment was published by Langgard in 1868, and books and monographs followed in rapid succession.

Thus toward the middle of the nineteenth century, at the close of the hundred-year period I have spoken of as dreary and demoralizing, gymnastic treatment began to crowd apparatus treatment and to absorb some of the attention previously given wholly to mechanical treatment. From this point gymnastic treatment has increased in prominence until it is fair to say that to-day it constitutes the bulk of the scoliosis treatment in America. Personally I believe that this is wrong, and that gymnastics are not suited to the treatment of moderate and severe structural scoliosis. I merely mention this as a qualification of the statement made above, and in explanation of my analysis of the progress of orthopedic surgery from this point.

Shortly after the middle of the nineteenth century there began what seems to me to be the first real progress that had been made in the treatment of scoliosis. To one who reads the history of the past the impression is left that up to this time the etiology had been the subject of a great deal of loose and irrational theory, that the recognition and identification of the affection had been delayed for centuries, and that all treatment up to this time had been, as we see it to-day, ineffectual and comparatively useless.

In 1878, Lewis A. Sayre published a book on "Spinal Disease and Spinal Curvature," in which he advocated their treatment by self-suspension and a plaster-of-Paris jacket. Self-suspension he credited to Dr. Benjamin Lee of Philadelphia and Prof. Mitchell of Philadelphia. He advocated the application of a plaster-of-Paris jacket in suspension, with the heels lifted from the ground, and he claimed for them nothing more than support in an improved position. The jackets were removable, and exercises were done daily. The treatment was too mild to be effective, but it contained apparently the germ of the modern progress in the treatment of the affection. The use of plaster-of-Paris jackets thus became more or less common in cases of Pott's disease as well as of scoliosis, and the work of Calot in 1896, who advocated at that time the use of forcible correction in the treatment of Pott's disease, suggested the use of more force than had been previously used in the correction of lateral curvature. Schanz published in 1900, an account of an efficient technic for the application of jackets in suspension, and reported results in 1902. In 1901, I reported results and described the technic where the patient lay on the face during the application, and there were other papers written at about this time, but the great impetus to the treatment by forcible correction came from Wullstein, who read a paper at the International Congress in Paris in 1900, and who published his experiments, methods and results in 1902. He showed experimentally that bony scoliosis could be produced in young dogs who were kept for some months in a bandage, inducing a lateral curve of the spine, and by the use of plaster-of-Paris jackets applied to the scoliotic patient in an improved position, induced by the use of great traction and lateral pressure, he secured results that were better than any previously reported. The work attracted much attention, and markedly modified the whole point of view with regard to forcible correction, which began to gather a body of adherents whose number has steadily increased.

The method of Wullstein has been extensively modified. Jackets have been applied with the patient on the face, on the side, on the back, with the spine flexed, with the spine hyperextended, on simple hammocks, and in complicated apparatus, but the principle demonstrated as effective by Wullstein and carefully elaborated by him has not been modified, namely, crowding the spine into an improved position and holding it there during as long a period as seems practicable, and for this purpose using plaster of Paris.

There have been from time to time pieces of work elaborated which have modified our point of view with regard to the etiology of scoliosis, and have to a certain extent influenced our treatment. The work of Böhm in 1906, called our attention to the frequency of congenital malformations as a cause of scoliosis, and immediately transferred many cases from the class of acquired scoliosis, to the class of congenital scoliosis. Subsequent work by Böhm and by others has laid stress on the fact that the occurrence of severe scoliosis is probably due to congenital conditions or to abnormalities of bone, and that too much importance must not be allowed to the former ideas that severe scoliosis was caused by assumed bad posture, carrying burdens, bad school positions, etc.

The discussion in the German Orthopedic Congress in 1910, with regard to school life as a cause of severe scoliosis was most illuminating, and the majority of the writers who participated were of the opinion that although the school might cause a postural scoliosis it was very doubtful if it could be accepted as a routine cause of severe scoliosis.

The monumental work of Schultess in the Joachimsthal Handbuch für Orthopädische Chirugie formulated, clarified and illustrated our knowledge of scoliosis.

In making this analysis I have tried at intervals to formulate to myself what was the treatment of scoliosis at any given time. I wished particularly to present the treatment of scoliosis as it existed in the middle of the last century, but I found that where I did not speak from personal knowledge I must be dependent upon one or another author, and that these differed so widely in their point of view that I could not present an intelligent short résumé, and with regard to the treatment of scoliosis to-day I find myself, where I do speak from personal opinion, in much the same position. What the prevailing treatment of scoliosis is to-day cannot be stated in a few sentences. Some men advocate one method, some another. To those of us who believe that forcible correction has accomplished more than any other treatment and will accomplish more in the future, the development of the real treatment of scoliosis dates from 1875. To those who believe that the gymnastic treatment of scoliosis is the best, and that forcible correction is wrong, the progress in the matter of scoliosis starts with Hippocrates and comes down in a wavering and discouraging line from that date until the present, with a better knowledge of the affection on the whole, with probably some more effective gymnastic technic, but without any very great advance within the last hundred years in the line of efficiency.

VII.

WHAT TO DO AFTER CORRECTIVE JACKETS ARE REMOVED.*

BY E. H. BRADFORD, M. D., BOSTON.

Whatever different suggestions may be presented as to the best methods in treating lateral curvature, all will agree that the whole treatment of structural scoliosis does not consist of or end in the correction of the curve. Many surgeons have suffered the disappointment of finding a relapsed deformity after a complete correction or overcorrection of congenital equinovarus and the probability of recurrence in a corrected curve and twist is even greater in lateral curves than in corrected deformities of the foot, for it is more easy to control the deforming condition in the latter than in the former class of distortions. Spinal curves dependent upon vices of growth due to static causes, faulty weight distribution, distorted muscular, or anatomical defect, will tend to recur during the growing years, until the tissues have gained in strength of structure sufficient firmness to prevent yielding to the ever present force of superimposed weight.

There should, therefore, not only be vigilance in the inspection of such cases with accurate methods of recording observations at stated times, enabling the surgeon to recognize a threatened relapse, but also measures for the counteraction of such a tendency in an early and more manageable stage.

To apply corrective jackets for a few months or a few years, remove these and leave the patient to take chances of future normal growth, with only as protection from relapse a reliance upon occasional gymnastics and waist biding, removable braces or jackets, cannot be regarded as thoroughly scientific surgery.

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* Read by title before the American Orthopedic Association, May, 1913.

Of the various ways of recording scoliosis, there are advantages in selecting one which can be accurately and quickly made, requiring no more skill than that furnished by an office attendant.

The glass plate tracing method is simple, and can be employed if a proper diopter is used, and the patient suitably fixed. A transparent celluloid sheet set in a frame has the advantage of lightness over the glass plate; an ordinary, four-post iron piping frame with side pelvis clamps furnishes fixation. An inexpensive diopter can be made by using a small wooden block, properly squared and of a size to be held in the hand, with a piece of tubing attached at one end. The surgeon looking through the tube of the diopter placed upon the upright transparent celluloid plate, close to which the patient's bared back rests, can carefully follow lines and contours without the error of a change in the position of the eye from a line vertical to the plane of record.

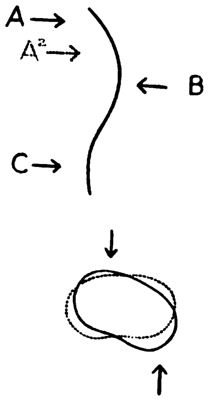

FIG. 1.

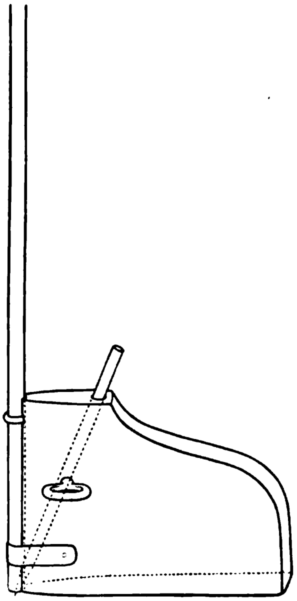

FIG. 2.

FIG. 1.—Diagram showing points of correcting pressure in scoliosis. Counter-pressure should be at A and not A 11.
FIG. 2.—Diopter and marking pencil.

If a pencil which can mark on glass is so placed in the block of the diopter that its marking point would strike the recording plate in the center of the inspection tube, an accurate record can be traced on the celluloid plate, from which it can be traced on tracing paper, and kept as a permanent record of contour lines of shoulder and hips, the position of the points of the scapulæ, and the line of the marked spines. A record of flexibility can be made if the patient is kept with the shoulders flat to the plate and the body bent sideways to either side, and the line of the marked spines traced.

The value of this flexibility test is greater than might at first be supposed. An examination of a number of these indicates considerable variations in the flexibility of different parts of the column and enables the surgeon to determine the local increase or diminution of spinal flexibility under exercising treatment and hence beginning relapse, and the urgency of a need for the employment of measures to prevent stiffening at any special part of the spine.

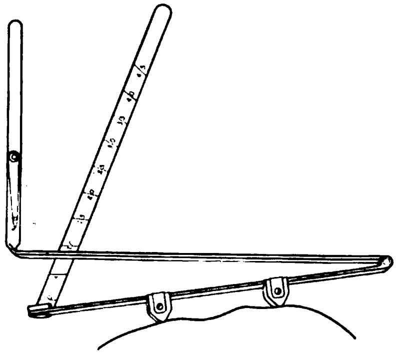

FIG. 3.—Rotation angle measure.

Anteroposterior curves need for this record a special means of tracing, for diopter tracing fails on account of the projection of the scapulæ. This is obviated by using for the tracing of the back the method recommended by Wollenberg, by which the shape of the trunk as seen from the side can be noted.

The accuracy of these tracings by diopter has been abundantly demonstrated as well as the ease with which they can be taken. It would appear that the method of testing the lateral flexibility of the spinal column is of use, enabling the surgeon to determine functional defects in the spinal column not recognizable by the unaided eye, by the X-ray, or by photograph. An examination of a number of these records shows a marked difference in lateral spinal mobility, which when not due to change in bone structure, as is probable in many cases, though recognized with difficulty, indicates structural changes in the ligamentous and muscular tissue in different parts of the column—changes which can, in favorable cases, be overcome by treatment.

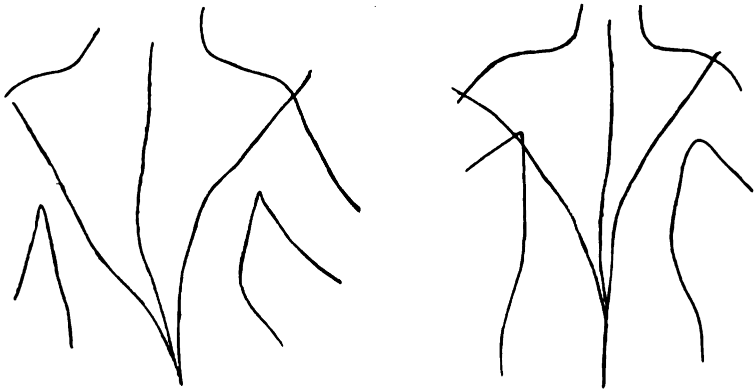

FIG. 4.—Diopter tracing of before and after three months treatment with corrective jacket showing the line of the spine and also the amount of spinal flexibility.

For recording rotation, various methods are offered for the surgeon's selection. The one, indicated in the accompanying illustration, is simple and the angle of rotation more easily noted than in the one more commonly used.

Photographs, pentagraphic records of cross-sections of the thorax—are all of assistance, but the method mentioned has been found to be simpler and of satisfactory accuracy.

A record of the strength can be simply made without the employment of elaborate strength test apparatus. A record is kept of the number of times certain prescribed exercises (using dumb-bells of a certain weight) can be performed. This record can serve as a table and an index of increasing strength; multiplying the weight of the dumb-bell by the number of the exercising movements, a strength index can be noted. The exercises to be noted in such a record will vary with the spinal curve, and in muscular weakness recumbent dumb-bell exercises, using the movements frequently prescribed for the correction of scoliosis, will serve as a basis for a strength record as well as for systematic muscular development needed in the after-treatment of lateral curves.

The great difficulty in rational treatment encountered in cases of structural scoliosis, is in the application of such means, as, after correction of the deformity, will prevent the assumption by the patient of faulty attitudes, without employing at the same time constricting corsets causing weakness of the trunk muscles, and without being so unsightly or cumbersome as to prevent contented use for the long period needed in growing children. A rigid leather or celluloid jacket, or the ordinary back brace does not meet the complex deforming conditions developed in faulty attitudes, where the surgeon with a moderate pressure of his hand can rectify a deformity, which quickly reappears but which is so slight a distortion that he hesitates to encase the trunk in a stiff corset binding the waist, necessarily weakening the muscles and inefficient in correcting rotation.

The difficulty is usually side stepped, the surgeon prescribing daily exercises, relying upon these for preventing relapse. Exercises, however, can only be rigidly enforced for a comparatively short period each day, while the need of measures to counteract the static influences causing relapse, is in many instances constant when the patient is erect. Various appliances have been devised, and none are entirely satisfactory—an indication that the subject needs farther investigation.

It is manifest that there is need of pressure and counterpressure in various directions, and that this counterpressure should be as effective as possible and applied at the extreme ends of the curve. It is mechanically absurd to apply correcting pressure only or chiefly on the lower part of the trunk, when the spinal column twists and as it is desired to check this. Any corset which twists with or around the trunk is, therefore, inefficient as a correcting force. It is better to frankly leave the patient to the correcting forces of nature than to use inefficient measures, which cause discomfort and even injure. But if the surgeon leaves scoliotic curves to chance, he must expect relapses in many cases.

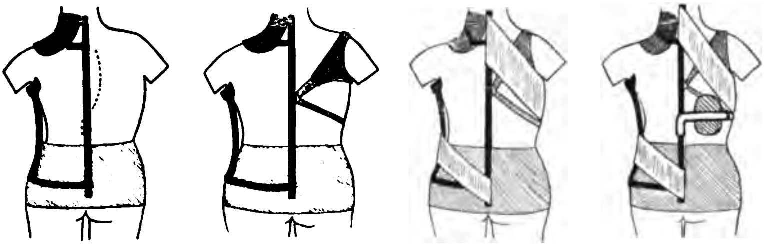

FIG. 5A.—Diagram illustrating check brace. 1. Showing steel upright side, crutch pelvic, and neck leather. 2. Same with shoulder strap. 3. Same with side correcting bands. 4. Same with rotation pressure pad.

It is of the first importance in a reliable check brace (meaning by this an appliance which will check a slump to faulty attitudes) that it should fit the pelvis at the hips, in order to prevent slippery twist. This can be satisfactorily furnished if a cast is taken, and leather is stretched around such a cast. A base for counter pressure, both lateral and diagonal, is in this way furnished, and the tendency to slip around the trunk checked.

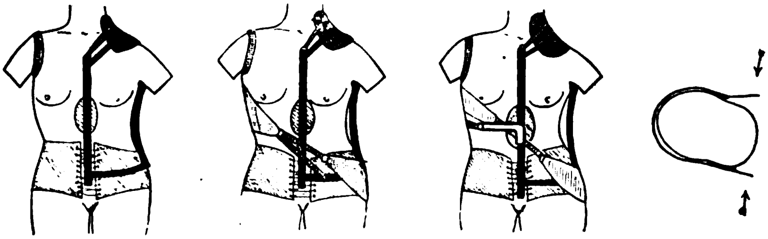

FIG. 5B.—Diagram of brace as seen in front with out-line showing points for rotation correction.

A leather collar can be molded at the neck for the upper point of counterpressure, extending down to the shoulder, but, as this has a tendency to project with the patient's movement, it is better to rely upon a strap for counterpressure, where it is important to avoid unsightliness of a conspicuous brace. A steel rod connecting the upper and the lower points of counterpressure serves to furnish a line for lateral pressure.

A light steel crutch, reaching from the pelvis to the axilla on one side, prevents the riding upward of the brace, and checks the patient's tendency to drop the shoulder.

Points for counterpressure being furnished at the neck and pelvis, side correcting pressure is needed upon the ribs at the region of greatest deformity. This can be arranged by a broad strap fastened to the steel upright at a desired point; and if buckled in front to the pelvis leather can be made to exert any desired amount of lateral pressure.

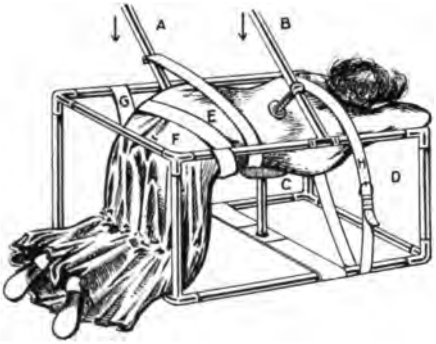

FIG. 6.—Apparatus for daily correction applied.

Where one shoulder is held high with projection of the scapulæ this can be checked by means of a shoulder strap connected with a strap which passing around the back upright is secured in front, pulling the shoulder back and down.

In front the neck and the pelvic leather should also be connected by a steel upright to give steadiness, and, if furnished with a leather pad, can be made to exert pressure upon the front projecting ribs.

In a majority of such cases, it is also necessary to check rotation of the ribs. This must be done by pressure, exerted in such a way that it will not also compress the flattened parts of the chest. Cross steel straps attached to the uprights and furnished with pads can be arranged like a clamp to press upon the projecting ribs without crowding the depressed portion of the trunk.

An appliance of this character needs careful adjustment at first, but can be regulated by the patient or nurse, and does not interfere with activity, and is not noticeably disfiguring. It will prevent the patient's tendency to slump into a faulty attitude. As it is removable, it can be worn only for such a portion of the day as is necessary to correct the greatest tendency to slump, or it can be used constantly, removed only during the gymnastic period. It furnishes the maximum amount of pressure with the minimum amount of injurious muscular constriction. As there is comparatively little objection on the part of the patient to a light apparatus of this character, correction can be employed as long as may be required in the child's growing period.

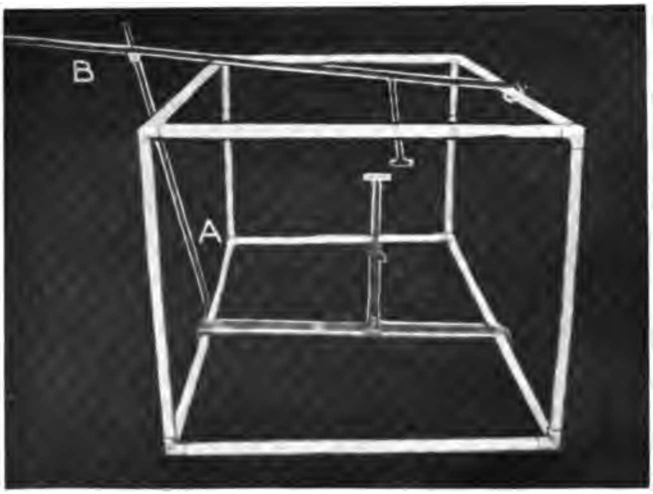

FIG. 7.—Diagram of frame for daily correction.

Little need be said here as to special muscular exercises necessary in these cases as so much has already been written upon the subject. It is sufficient to say that dumb-bell exercises properly directed can serve excellently for special muscular development by daily home exercises; they can be simple and suited for home direction.

Something more, however, than muscular exercises and check braces are needed in the more obstinate of these cases. A constant tendency of certain ligaments to lose elasticity exists when faulty attitudes are constantly assumed. This danger of adaptive change in ligament and fascia is to be counteracted by direct correction or overcorrection of a faulty curve. This can only partly be effected, and in some instances not at all, by muscular exercises, and should be made when the muscles are relaxed in order to overcome muscular resistance. Correction of this sort must be accurately applied, and should be of such a character that it may be made a part of the daily home routine. An arrangement indicated in the accompanying illustration will be found to have certain advantages for home correcting exercises. It consists of an oblong piping frame with cross cloth straps for head, shoulder and pelvic rests for the patient, who kneels head downward in the frame; side straps with weight pulls to keep pelvis and trunk in a correcting direc-

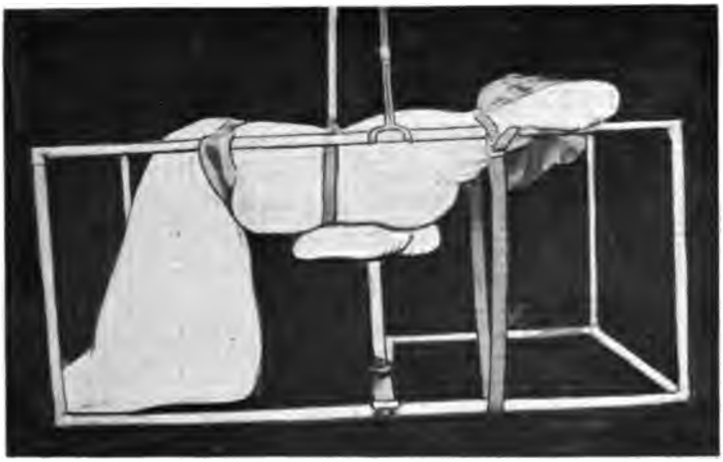

FIG. 8.—Side view of patient in frame.

tion, and by means of a lever with pressure attachment the twisted thorax can be overcorrected at any desired section. The amount of correcting pressure can be easily regulated.

This arrangement for daily correction can be used also in the application of corrective plaster jackets, and it will be found of advantage for this purpose in many cases, especially in the higher curves.

The avoidance of conditions favoring faulty attitudes is advisable in the after-treatment of spinal curves, corrected or in the earlier stage of development.

The avoidance of sitting for long period without the interruption of a period of active play, the enforcement of a period of flat recumbency or the prone position to rest the back muscles, serves as an aid to prevent a habit of faulty attitudes. Lounging in large, or deep, or broad-seated chairs, is to be avoided, as it favors a twisted attitude. Expensive, especially made chairs, are not necessary. A narrow-seated stool or chair with proper attention to the length of the legs can answer for study or any occupation requiring a seated position for some time.

Night corrective appliances are as a rule not necessary for cases of structural scoliosis after the stage of plaster-of-Paris correction, nor in the slighter flexible cases. If this is not the case, the appliances mentioned can be worn as a night appliance with but slight alteration and padding to protect the night clothing. It is not more uncomfortable than a plaster jacket.

Antero-posterior Curves.

While the principle of the correction of antero-posterior spinal curves is the same as that of lateral and rotary latent curves, the applications of these principles necessarily varies on account of the difference in the anatomical relation of these curves.

Plaster-of-Paris correction is less and gymnastic correction more effective in correction of the former than of the latter curves. It is also true that satisfactory braces are less easily applied in the former class of curves on account of the difficulty in arranging for counterpressure at the upper part of the curve but correcting pressure more effective when applied as less correcting force is needed.

A satisfactory antero-posterior check brace can be made by attaching to the pelvic leather girdle a steel upright passing up the middle of the back. This at the top is connected with a stock of leather or cloth which should exert counterpressure on the sternum at the sternoclavicular articulations and on the lower part of the neck. The shoulders can be drawn back (and should be allowed to drop) by shoulder straps crossing in the back and which are buckled to the leather in front and help to exert pressure on the protruding abdomen.

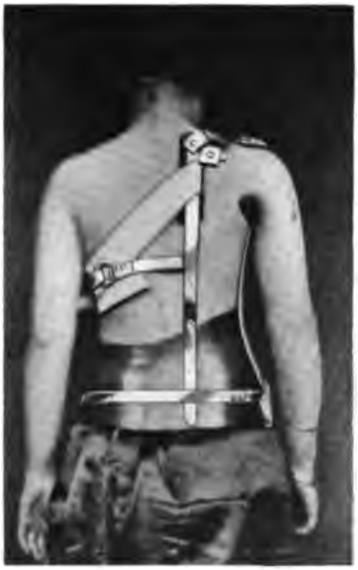

FIG. 9.—Patient wearing check brace for a reversed curve.

The amount of literature on the subject is so great and the different views of writers investigating the problems of the etiology and pathology of spinal curves so varying, that the reader may well conclude that the subject is a complicated one. In fact, however, the theory of the treatment of scoliosis and spinal curves is simple; viz., the affection being largely a vice of growth, treatment must consist in the guidance of tone and tissue growth aided by correction when possible, of an existing deformity of bone or of a misplacement of bone.

A surgeon cannot be content to simply twist a crooked spine and then end his efforts at that. He must consider the tendency which still persists toward faulty attitudes and vicious static influences.

The deformity of knock knees or bow legs can be corrected by force, and after the healing of the resulting trauma in the majority of cases the patient *is* cured and a relapse is not to be expected because the body weight comes correctly upon the limbs. The spinal column and the trunk are more complex structures than a single long bone, the vertebræ cannot be osteotomized or broken and a faulty tendency has in many instances to be checked by correcting influences continued through a relatively long period. As Lange has said there is no royal road in the treatment of scoliosis.

Certain facts are to be held in mind by those treating fixed spinal curves.

The best method of correction is by properly applied plaster jackets. But correction of the curve is not curing to the patient. Gymnastics are adjuvants in treatment, but not to be relied upon exclusively when a relapse is threatened.

Check braces are of assistance if they prevent slumping and faulty attitudes.

Such braces should not be waist or thorax compressing corsets. As there is a tendency to relapse during growth, inspection and treatment may be needed for a long period.

Ugly, heavy, disfiguring appliances should not be applied for an indefinitely long period.

To be honest with himself the surgeon should in watching the most chronic of surgical ailments keep accurate records and measurements of contour, flexibility, curve and rotation to enable him to detect relapse definitely and to note gain positively.

VIII.

THE ROTATION TREATMENT OF SCOLIOSIS.

BY A. MACKENZIE FORBES, MONTREAL.

In bringing this subject once again before the surgical profession the writer must admit his inability to say whether scoliosis has ever been treated in the past by rotation alone; yet, "is there anything whereof it may be said, see this is new? It hath been already of old time, which was before us."

For some years the writer has treated this affection by rotation. Over two years ago he first brought this subject before the Canadian Medical Society in a paper entitled The Paradoxical Treatment of Scoliosis. In July last he published a description of treatment by rotation, in the *New York Medical Journal*, and in October last he again brought this subject before the medical profession of Montreal.

In order to have a clear knowledge of the mechanics and theory of treatment by rotation, it is necessary to have a definite idea of the movements possible in the normal, and the mechanics of these movements, and especially of the inter-relation between the movements of the vertebræ and the movements of the rib walls of the thorax.

The study of the mechanics of thoracic movements and the study of the treatment of scoliosis by rotation is not easy. It is tiresome and difficult, yet it is worth while. Before beginning this study, let the writer say that his inspiration originated during an endeavor to find the best position in which to place a scoliotic for treatment by the older methods; that that study lead to an avid investigation of the literature on scoliosis and that the works which proved of greatest help in this investigation were those of Feiss. After having formulated the theory about to be enunciated it became necessary to make converts of some of those who were sufficiently interested in scoliosis to have become thoroughly discouraged with our lack of results in treatment, that these might help to get results in order to prove the efficacy of the rotation method, and here I would acknowledge my indebtedness to Adams of Boston for his critical study of these theories and for his untiring efforts to demonstrate in practice that results may be obtained by the application of the theories set forth for the treatment of this affection.

Let us now begin our study by considering the normal.

The body is not a firm mass, but consists of segments jointed together, one segment resting upon the other. To prevent the body from collapsing, connection between segments must be rendered firm. This is done by tightening the tube of tissues connecting superimposed ones. Then, to maintain the erect attitude the line of gravity must pass through the base of support. So, in all postures in which balance is maintained, there is a constant equilibration by means of shifting segments (Rimmer, Herman).

But whether for the sake of balance or not, the result of this segmental movement must mean that the tube of soft parts made up of muscles, fasciæ and integument, and joining adjacent segments is subject to a constant change in tension, so that if one segment moves on an underlying one, the fact that motion takes place means that the soft parts which connect them must be in greater tension on some sides than on others (Figs. 1 and 2). So again, in the maintenance of an erect attitude which is asymmetrical, the tube of soft parts is subject to difference in tension in accordance with the amount of shifting of superimposed segments. In a word, the attainment and maintenance of all positions entails a firm tonicity and tension in those parts of the body in which the segments are most separated (Zuckerkandl and Erben, Duchenne, Spencer).

If one leaves out of consideration the presence of the ribs and sternum, then the whole trunk wall is to be regarded as a cylindrical or sac-shaped tube containing the viscera. The muscles which take part in the fastening together of the same

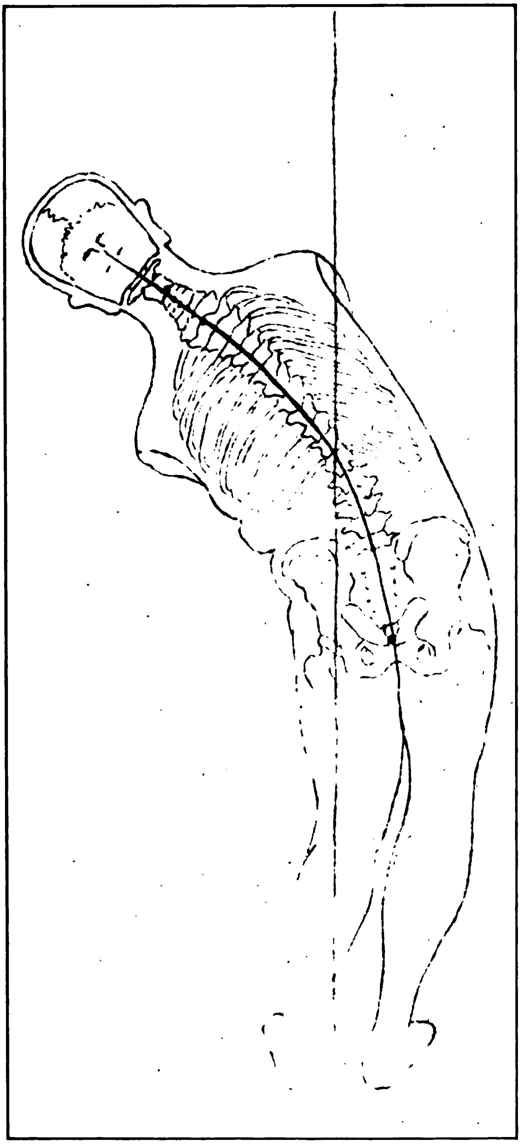

FIG. 1.—From Feiss. Demonstrates the position of the thoracic parietes in side-bending and most important, the similar effects of rotation and side-bending. Both cause physiological scoliosis. (This diagram should be studied in conjunction with Fig. 2).

can only have the significance of furnishing a resistance against the pressure of the viscera, or that of direct pressure on the viscera. In either circumstance this effect must be such a one as would diminish the tube in its diameter and therewith narrow the space present in the same (Figs. 1 and 2).

Movements Possible.—A most important fact, and a fact which governs the treatment to be advised in this paper, a fact which has been demonstrated by Guerin, Sappey, Quain and Hess, is that there is little lateral and anterior-posterior motion in the dorsal region.

The barrel-shaped thorax usually moves as a whole; yet, in spite of this such authorities as Volkman, Lovett, Quain, Schulthess, Menard and Guibal, agree that there is some intrinsic movement theoretically possible here, and of all intrinsic movements *rotation is the freest of dorsal movements.*

Rotation of the thorax as an entity or whole takes place in the very lowest dorsal region, but amongst the dorsal vertebræ, individually, reaches its greatest extent in the upper dorsal region. In the lumbar region the direction of the articular facets tends to prevent rotation.

Lovett first pointed out some years ago that the greatest mobility to be had between dorsal vertebræ was in flexion. This you can easily prove by attempting rotation of the thorax on a fixed pelvis. As soon as one attempts to get extreme rotation the patient, as if to facilitate this involuntarily, bends forward. This is probably due to the fact that flexion unlocks the articular processes of the vertebræ.

Feiss has been most particular in drawing attention to the fact that the barrel-shaped thorax moves as one. In fact, he seems to believe that there is little movement between individual dorsal vertebræ. This, I am sure, is (comparatively speaking) a correct view. There is less movement possible between individual vertebræ (in the dorsal region) than there is between the dorso-lumbar vertebræ, yet skiagrams and models as well as photographs distinctly demonstrate a not inconsiderable movement possible in this region.

Effect of Movement.—One of the most important points

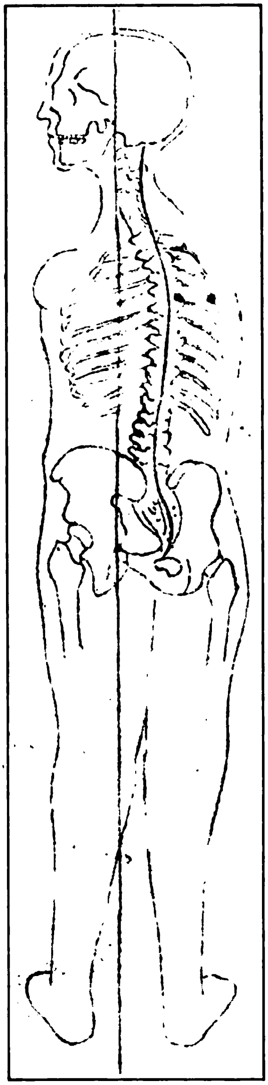

FIG. 2.—From Feiss. Demonstrates the position of the thoracic parietes in rotation. It demonstrates the similarity of the parietes in either rotation or lateralization, and lastly the similarity between physiological and pathological scoliosis.

demonstrated in the study of the thorax is, that tension on the rib wall caused by either rotation or side-bending causes a very distinct change of shape in both lateral walls of the thorax (Figs. 1 and 2). In fact, the thorax behaves in either of these movements as a hollow rubber tube the wall or side under tension becoming narrowed, the converse side becoming broadened. At the same time certain definite changes take place in the spinal column.

This comparison between the tube-shaped thorax and the rubber tube is important because of what we may call the *elastic limit.* There is a limit to the elasticity of a rubber tube. There is a limit also to the elasticity of the thoracic tube.

Feiss has said that whatever motion is made and whatever the cause of motion, there is always an element of tension in the soft parts which connect adjacent segments.

In the thorax the greatest tension must come upon those factors to which this segment owes its maintenance of shape, namely, the ribs. Indeed we must acknowledge that either rotation or lateralization means or is followed by, extreme and diverse changes in the two sides of the thoracic parietes (Figs 1 and 2). In a side bend the tissues running over the thoracic wall on the convex side are immediately stretched so that if there is any elasticity in the rib wall they will give on that side; for, as the body lengthens here, the muscle wall will tend to approximate the bending column. It has already been demonstrated that the approximation of the side wall to the column means a direct strain upon the interposed rib wall. The tendency which follows is for the angles of the ribs to become sharpened on that side because these angles are thus forced into a position of strain. The ribs will tend also to separate because of the tension on them, and also, they will tend to incline in a downward direction. On the opposite side, namely that of the concavity, the ribs become crowded together and there is no tendency to sharpen their angles (Figs. 1, 2 and 3).

In side-bending the strain is from above down tending to narrow the strained side and exert pressure on the articular surfaces of the vertebræ at the side of the strain, Fig. 4. In twist, on the other hand, the strain is in a direction from behind forward. It acts on the vertebræ by leverage, a force, as you know, far greater than that of direct pressure.

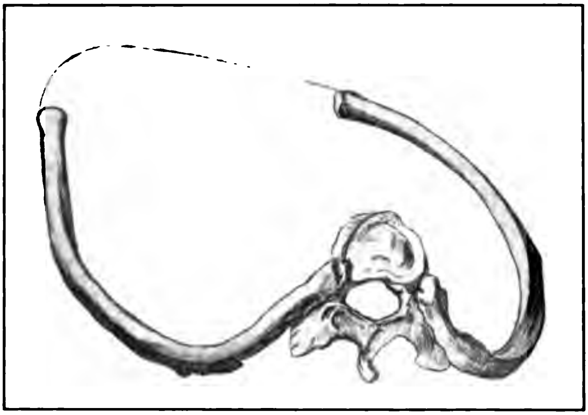

FIG. 3.—From Feiss. Demonstrates the deformity of scoliosis.

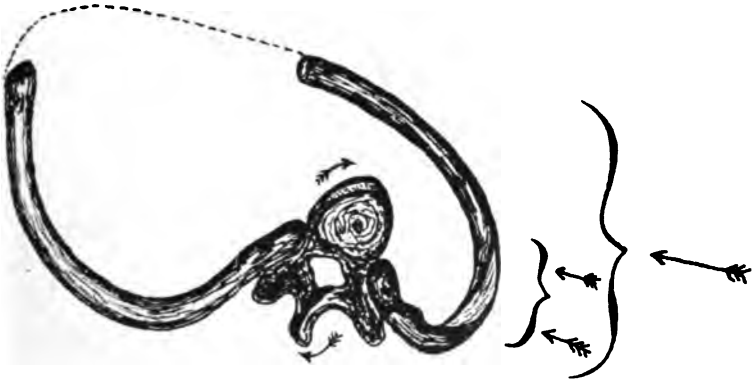

FIG. 4.—Diagram showing the effect of side pressure on the rib wall. Side pressure on the rib wall is transmitted to the posterior part of the vertebra by the attachment of the rib to this. The vertebra rotates. The body is approximated to the rib wall on which pressure is made.

It is important to understand clearly that if the ribs are under strain, this strain will be communicated to the spinal column, and as the ribs articulate with the vertebræ more posteriorly than anteriorly it will be the row of neural arches and the posterior part of the bodies that first become strained or are acted on by this force (Fig. 4). This is important, because it will be thus the posterior parts of the vertebræ which will tend to give during strain to the thoracic wall and the spinous processes will be pushed in one direction while the anterior parts of the bodies of the vertebræ are being approximated to the bent wall in an opposite direction (Forbes, New York Medical Journal, July 6, 1912).

Rotation by twist of the thorax, as a whole, is followed by the same pressure on the posterior surface of the vertebræ as in side-bending (although applied differently), and the same rotation of the anterior part of the vertebræ toward the side of that pressure.

The importance of these statements lies in the fact, that they demonstrate that any active movement places the ribs under strain which tends to change their shape and direction, and that such strain is communicated back to the vertebral column and tends to rotate each vertebra by pressure or leverage on its posterior part. A normal thorax is continually subjected to such stresses and strains. These are counteracted by the elasticity of the parts, but *there is a limit of elasticity.* If the elastic limit is passed there is no return to the normal and lack of balance and deformity result. Thus the physiological may become the pathological.

Pathology.—The deformities are of the trunk, and especially of the thorax. All the component parts of the thoracic parietes enter into the deformity as a whole, but the deformities of each lateral thoracic wall are, in character, diametrically opposed to one another (Figs. 3 and 5).

The deformities of scoliosis include a lateral deviation of the spine. This is but one of a series of deformities. It is questionable whether it is not a secondary deformity and unlikely to be of as great importance as the deformity of the rib walls already mentioned.

Scoliosis, then, is not a deformity of the spine alone, as it seems to have been so frequently considered. It is a deformity of the trunk as a whole, but especially of the thorax.

Deformities of the Thorax.—In the graver forms there is a posterior prominence and a lateral descent of the ribs. This is

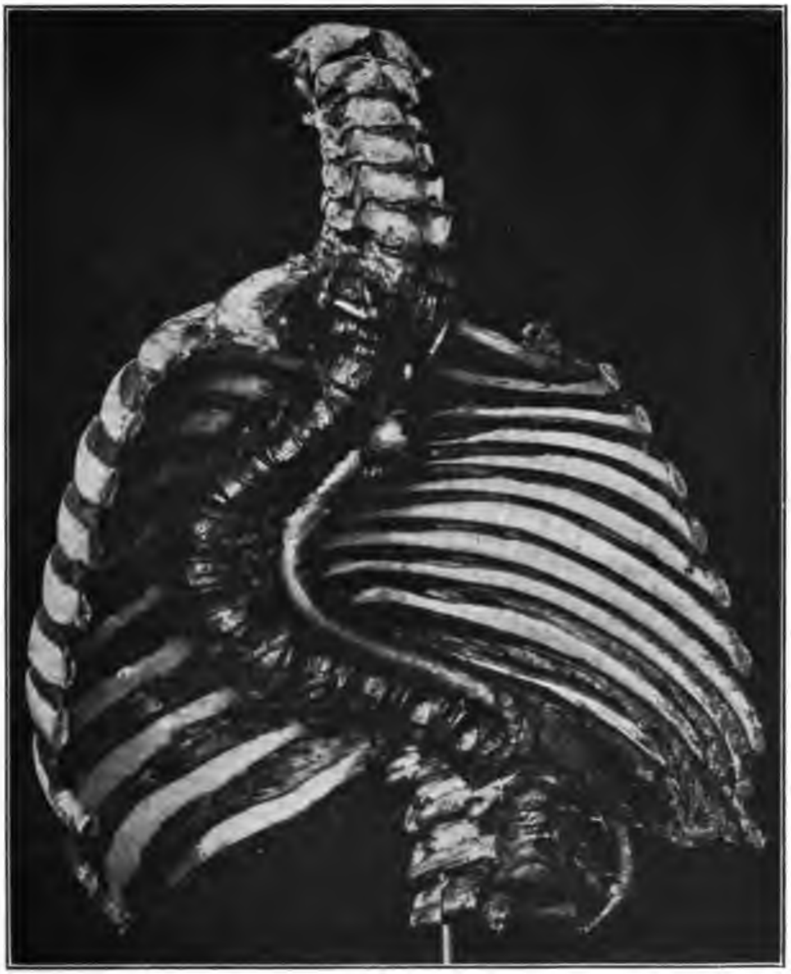

FIG. 5.—Pathological specimen of a scoliotic patient from the Warren Museum. It shows the narrowing of the thorax to the side of the convexity of the spinal curve and the rotation of the vertebral body, toward the same side. Published by the kindness of Prof. Whitney.

usually of the right ribs. The rib wall seems to have been crushed in toward the spinal column. It is flattened. The posterior convexity is sharp and razor-like. On the opposite side the ribs are deep and hollow behind, but, as a rule, prominent in front.

Deformities of the Spinal Column.—The spinal column is curved usually in the dorsal region. The curve is convex toward the side on which the ribs are prominent. (In this, organic scoliosis differs, at least apparently, from a postural or physiological scoliosis, where the curve is concave toward the side on which the ribs are prominent.) There are compensatory curves, usually in the cervical and lumbar regions—perhaps also in the dorsal region. These compensatory curves are in obedience only to the laws of gravity.

Consideration of the Deformity in Relation to Treatment.—In examining the thoracic parietes both by means of Röntgen Rays and otherwise, one is impressed with the effect of certain movements or attitudes upon them.

Side-bending will, for instance, cause a flattening of the rib wall on the side of the convexity of the curve, a retrogression of the posterior part of the rib and a rotation of the vertebræ causing an approximation of the vertebral body to the flattened parietal wall (Fig. 1). Rotation will act to produce a very similar condition (Fig. 2). Thus, by attitude we may obtain a similar condition of the thoracic parietes to that seen in pathological scoliosis (Figs. 3 and 5).

The deformity of organic scoliosis has evidently its counterpart in functional scoliosis. The only difference seems to be that in organic or pathological scoliosis we have fixed deformities, whereas in physiological scoliosis the deformities are not fixed, but rather, disappear on the assumption of an opposing attitude.

We must now accept the statement that irrespective of all other forms of scoliosis, we have organic or structural scoliosis in which there is definite bony change, and functional scoliosis which is not accompanied by bony change, and which is due to attitude. In this paper we will call the first, pathological scoliosis, and the second, physiological scoliosis.

In our study of the pathology of organic scoliosis we have noticed that the two sides of the thoracic wall in this affection are deformed. There is a bulging on one side posteriorly. There is a bulging on the other side anteriorly (Fig. 3). An examination made of a horizontal section through the thorax of a scoliotic demonstrates that the two lateral walls, or if we consider the section being studied, a sphere, the two hemispheres present converse deformities. Treatment then should aim at reversing this (Fig. 6). In other words, treatment should aim at placing the thoracic parietes in a position as far removed from their present deformity as possible, and to maintain the parietes in the new position until such shall become their normal, not by any art on the part of the operator but by the fulfillment of Wolff's Law, which is, "Every change in the form and function of the bones, or of their function alone is followed by certain definite changes in their internal architecture, and equally definite secondary alteration of their external formation in accordance with mathematical laws."

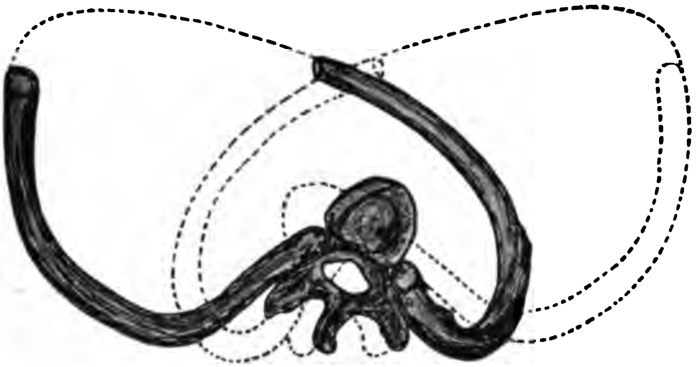

FIG. 6.—The dark figure represents pathological scoliosis. The dotted figure superimposed upon it represents physiological scoliosis—in this case the counterpart of the pathological scoliosis shown in this figure.

How, then, may we aim at producing the counterpart of an existing organic scoliosis? By posture. It has already been shown that the deformity of *pathological scoliosis has* its counterpart in *physiological scoliosis*. As far as possible treatment should aim at changing the form or shape of the two sides of the thorax the one for the other. This can be done by producing physiological scoliosis of a type reverse to the existing type of pathological scoliosis.

Our study of the possible movements of the thoracic parietes has demonstrated that physiological scoliosis may be obtained by either side-bending or by rotation (Figs. 1 and 2).

In the past, treatment has been by side-bending. The operator has rarely argued that his points of pressure and counter-pressure really were a form (though a poor form) of treatment by the production of physiological scoliosis. His effort has been to obtain the strongest possible pressure over the site of the greatest spinal convexity and this I feel often to the detriment of the patient. The treatment of scoliosis in the past has not been marked by brilliant success. Yet why? Surely some operators have succeeded in "obtaining the strongest possible pressure over the site of the greatest spinal deformity!" It seems that there has been something fundamentally wrong in our conception of this deformity or successful treatment would have been more frequent.

Perhaps our lack of success has been due to the fact that we have forgotten that scoliosis is not a deformity of the spine alone, as it seems to have been so frequently considered. It is a deformity of the trunk as a whole, but especially of the thorax. In the past, scoliosis was said to be, or to be due to, a lateral curvature of the spine. With this curvature came rotation. To-day one questions whether the lateral curvature of the spine is not coincident with the deformity of the chest walls. An examination of the spine demonstrates in organic scoliosis not only *curvature or curvatures* of the spine as a whole, but *rotation* of individual vertebræ. The body of each vertebra in organic scoliosis is rotated toward the convexity of the spinal curve (Fig. 5).*

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* In non-organic scoliosis this is not the case. In functional curves it is probable that at first the side-bending of the spine is masked by the rotation of the spinous processes to a position opposite to the side of the posterior prominence. As this increases, however, it becomes apparent: then comes the deformity of the individual vertebræ, the spinous processes are deflected toward the side of the convexity by structural change. By gravity, the side-bending becomes so great that the deflection of the spinous processes away from the bodies which was at first masked and then apparent, soon ceases to be noticeable, thus the spinous processes of the vertebræ in structural cases point or appear to point to the convexity of the curve.

The *rib wall is crushed* down to meet the convexity of the curve (Figs. 3 and 5). It has already been stated that in the past scoliosis was looked upon simply as "curvature of the spine," although it was not denied that rotation and deformed rib walls accompanied such curvature. Rarely was it asked which, if any, of these three deformities appeared first. Possibly we assumed that the curvature *was* the cause of the other two. That the curvature *is* the cause of the other two is open to doubt. Looking upon the curvature of the spinal column as the evil to be fought, treatment has been directed against, and often wholly against, this. Often an attempt to unlock the deformity was made by making pressure on the greatest convexity of the spinal curve. The pressure was made through the rib wall. Was it not an error to make such pressure, because it tends to increase the deformity of the rib wall and to increase the rotation of the vertebræ (Fig. 4).*

Physiological scoliosis may be got by pure side-bending, without the use of pressure on the greatest convexity of the deformity, which has been in the past the most objectionable feature of treatment by side-bending (Fig. 1). The greatest deformity is usually in the dorsal region. Why then should we not, in preference to side-bending, choose rotation to secure physiological scoliosis, as rotation in this region is the freest of all movements? Another objection to side-bending is, that the attitude induced by this is not borne so easily by the patient as is that induced by rotation and further the attitude produced by rotation may be unconsciously compensated for by the patient (Fig. 7).

The influence of rotation on the spine and thoracic walls has always been a subject of debate. In 1903, Lovett (*Boston Medical and Surgical Journal*, August 6, 1903) wrote an interesting article on torsion in lateral curvature of the spine. He seems to have twisted the spine of a cadaver by means of

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*Lateral pressure on a rib wall which is already "crushed in" must of necessity increase this deformity. Further it has already been demonstrated that lateral pressure increases the rotation, and when applied in the manner employed in some of the older methods of treatment such lateral pressure simply approximates the rotating body of the vertebræ to the rib wall.

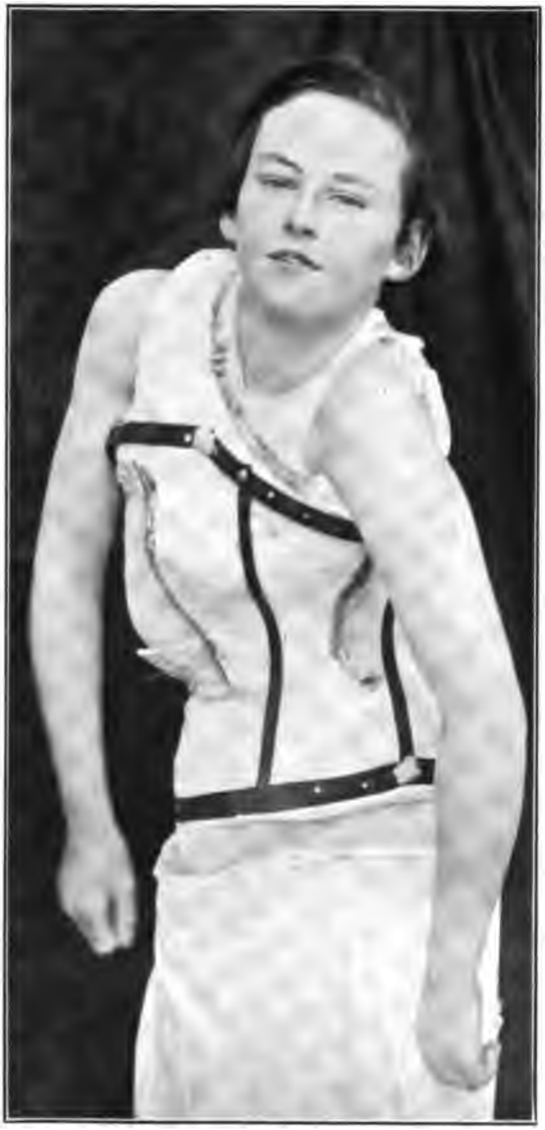

FIG. 7.—Photograph of a child treated by the rotation method. The rotation of the child's thorax is distinctly shown. The jacket which maintains this rotation until Wolff's Law will confirm the correction, with its windows to allow of the expansion of the contracted parts, will be noticed.

a wrench fastened to the third dorsal vertebra. He found that a lateral curve always accompanied the twisting and occurred always to the *left* when the twisting was to the *right* and *vice versa*. A few years ago, to my astonishment, in making some experiments I found that by twisting a patient to the *right* as did Lovett but by the arm (instead of with a wrench) I got an apparent side-bending to the *right* and *vice versa*. I seemed to have discovered a paradox. Later I saw that Lovett's procedure differed from that of mine. He applied force DIRECTLY to the spine and it rotated on its own center of rotation. I applied force to the thorax and INDIRECTLY to the spine (Fig. 8). When I rotate by means of the arms I act on the rib wall. The ribs act as levers on the posterior part of the vertebræ. The vertebræ rotate about their centers of rotation, and, as the pressure is exerted more posteriorly than anteriorly they rotate toward the direction of the force applied. Thus the bodies of the vertebræ are turned toward the rib wall so acted upon,

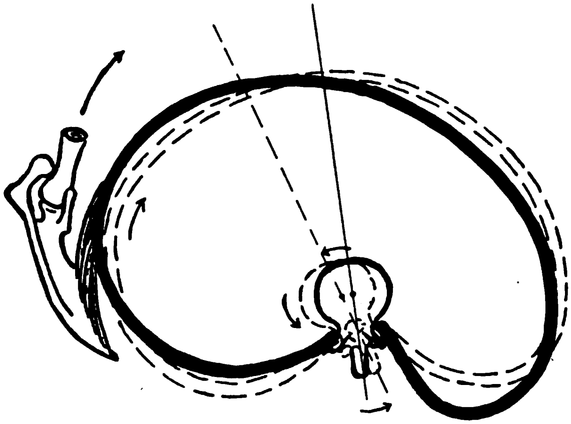

FIG. 8.—Demonstrates the effect of rotation, by the arm, on the rib wall and the spinal column. Power to create torsion by means of the arm seems to be transmitted through it to the thorax by the Serratus Magnus and allied muscles. As the part of the rib wall pulled upon advances that portion of the rib wall which is posterior to the angle recedes and presses upon the posterior part of the vertebra, and as the center of rotation in the vertebra is anterior to the part pressed upon the body of the vertebra must be approximated to the rib wall so acted on.

while, of course, their spinous processes are turned in an opposite direction (Fig. 8). We have, therefore, in rotation of the thorax to the right, an apparent side-bending to the right, while in reality we have an approximation of the body of the vertebra to the chest wall to which the force is applied—the last thing in the world which we want to get in treating scoliosis.

Is it possible that we have erred in the past when we have treated by applying force to the convexity of the spinal curve? What do we do? We approximate the vertebral body to the rib wall. We increase the rotation of the vertebræ.

Some have gone even further. They have not only endeavored to cause correction by direct pressure but they have done the most natural thing. They have rotated in a wrong direction.*

Under the circumstances that some have been correcting by side-bending in one direction and deforming by rotation in an opposite direction, we cannot wonder that the treatment of scoliosis has not been in the past a marked success.

Treatment.—The Rotation Treatment of scoliosis aims at causing the correction of the deformity by the production of its counterpart. The production of physiological scoliosis of an opposite character to the pathological scoliosis which already exists, is undertaken by rotating the patient's thorax on a fixed pelvis in a direction toward the side of the convexity of the curve. In thus producing physiological scoliosis of an opposite character to the pathological scoliosis from which the patient suffers, we not only change the curve of the spinal column but we change the deformity of the thoracic walls; that side which bulges unduly is flattened, and the flattened side is filled out (Fig. 6).

We have already shown in this study that the chief deformities of scoliosis are in the thorax; that rotation is the chief movement of the dorsal spine and that the greatest rotation possible is to be had when the dorsal spine is flexed, because here, probably, the articular processes of these vertebræ are in a position furthest removed from impinging on one another.

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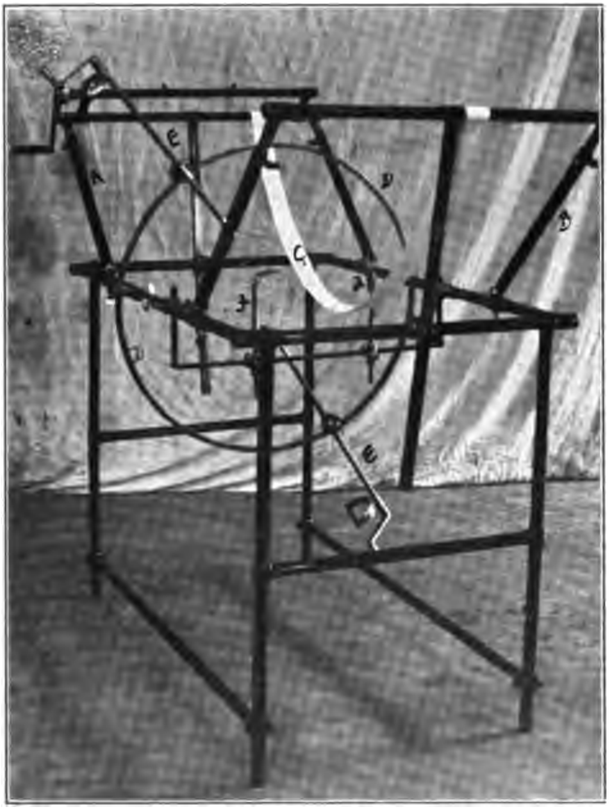
*This some will remember was the fundamental principle on which the paradoxical treatment of scoliosis, suggested by the writer some years ago, was founded, and further it is the principle of several well-known methods of treatment used to-day.

We have drawn attention to the difference in the behavior of the spinal column when submitted to twist, say by a wrench, and when submitted to the same by means of the attached ribs.



FIGS. 9 and 10.—Photograph of a model of apparatus for the rotation treatment of scoliosis. This demonstrates, *A* and *B*, the arms which support the hammock; *C*, on which rests the back of the flexed patient; *D*, represents the hoop by which rotation is assured. This carries two handles, *E E*, which are grasped by the patient with outstretched arms prior to being rotated. *F F*, show the arms which hold immobile the pelvis during rotation of the trunk through the upper extremities and the passive resistance of the serratus magnus and allied muscles.

We will, then, endeavor to obtain the greatest possible rotation of the thorax and, by means of the rib wall, of the vertebræ (Fig. 8). As we can best obtain this when the thorax is in the flexed position we will rotate the patient by means of the arms after having flexed the thoracic spine.

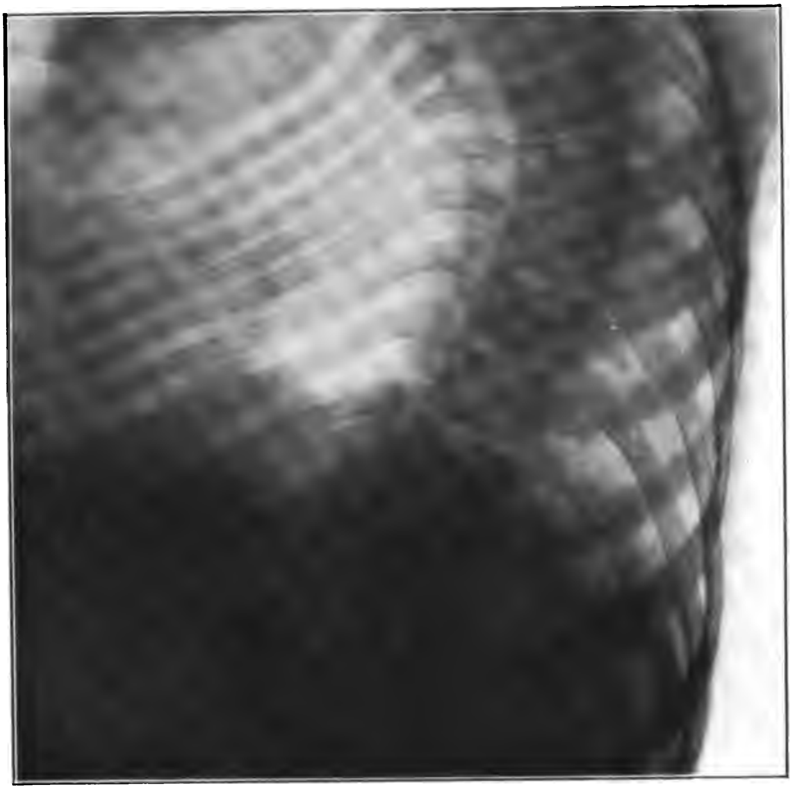


FIG. 11.—M. L. A child suffering from scoliosis with the convexity to the right. This patient has been rotated as far as possible to the left, *i.e.*, away from the deformity. This increases the deformity—the flattening of the ribs on the right and the convexity of the curve to the right.

In doing this, the paradox already mentioned must always be kept in mind; the vertebræ rotate in a direction opposite to that of the thorax (Fig. 8).

Those who employ this physiological form of treatment by rotation believe that the aim and object of treatment in scoliosis should be to place the thoracic parietes (including the vertebræ) in a position of correction removed as far as possible from their present position of deformity. There they must be held until by Wolff's law they have been so changed that it has become possible for their new and more normal position to be maintained. In scoliosis of a non-paralytic type this may be done by the application of plaster of Paris.*

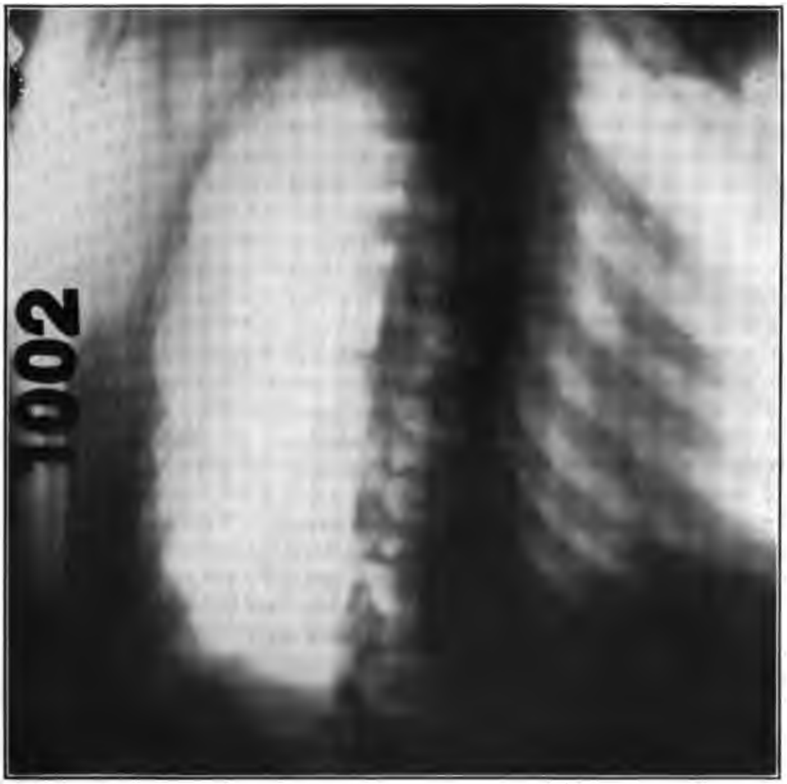


FIG. 12.—M. L. The same child as in Fig. 11. The patient has now been rotated as far as possible to the right, *i.e.*, toward the deformity. It will be noticed that the deformity has been improved here. The spine seems straighter. The flattened ribs on the right have been broadened.

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*In scoliosis of a paralytic type neither plaster nor dependence on the law of Wolff will suffice. It is feared that the best treatment for these may prove to be the use of buried splints of either bone or steel.

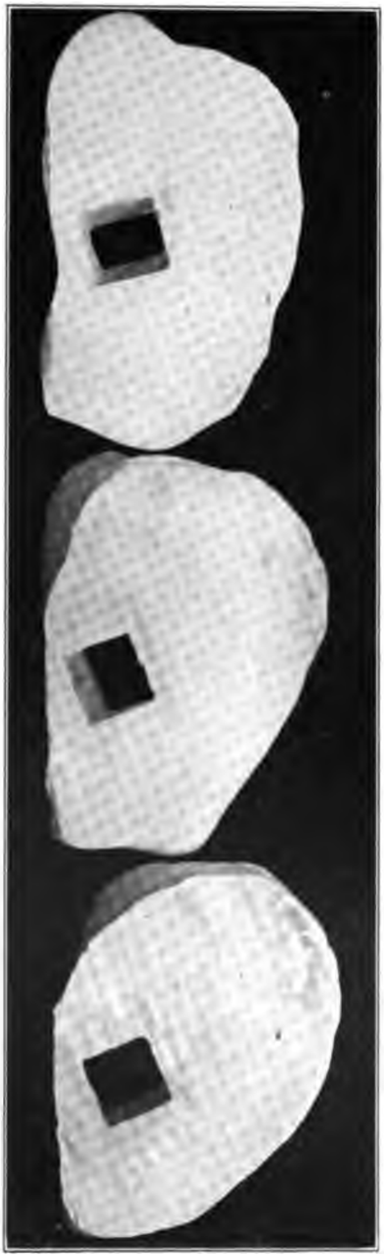
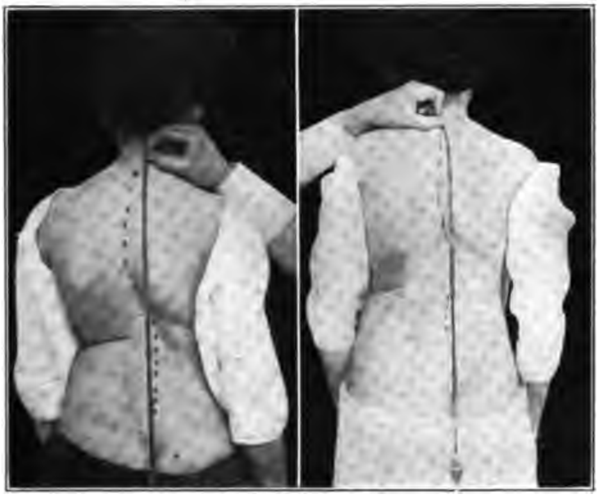


FIG. 13.—Photograph of transverse sections of torsos in the Children's Hospital (Montreal). These demonstrate the real deformity of the scoliotic, and should be compared with Figs. 3 and 5. "In scoliosis there is a prominence of the ribs on one side posteriorly and at the same time there is a bulging of the ribs on the other side anteriorly."

The primary deformity being found, its counterpart is produced by the induction of physiological scoliosis by rotation (Fig. 6). The charms of this form of treatment lie in the fact that each step undertaken can be thought out and a reason suggested for every move, and that any one can produce correction without apparatus and simply maintain the same by the use of plaster of Paris. The writer employs a more or less complicated and continually evolving apparatus (Figs. 9 and 10) in order to secure the greatest possible rotation. Doctor Adams of Boston uses no very special apparatus and yet can show most gratifying results.* All one has to do is to rotate by



FIGS. 14 and 15.—(Photographs of patient, Y. P., at Children's Memorial Hospital.) Demonstrates improvement by treatment. Fig. 12, taken November 16, 1911. Fig. 13, taken February 7, 1912. During this time the patient had been treated in one jacket applied in the method described.

*In a paper being published synchronously with this article, Doctor Z. B. Adams of Boston draws attention to the way in which the deformity of scoliosis is relieved by rotation carrying back the vertebræ into a more normal position by physiological methods. He presents diagrams to show different attempts at rotation, and a photograph of a child being treated by rotation in the simple apparatus used by him and recommended by me, for the use of those who have accepted the theories of the physiological treatment by rotation, and who are willing to try the practical application of them. Further, Doctor Adams speaks of the results of treatment by this method as practised by him.

means of the arms and fix. We rotate in flexion because we get greatest rotation in this position: we most carefully cut out windows over contracted thoracic walls and provide pressure over bulging walls: we recommend a course of breathing exercises calculated by my colleague Doctor F. W. Harvey of Montreal to expand contracted parts: but the principle remains the same. These are simply adjuncts to the real form of treatment which is the induction of physiological scoliosis by rotation.

IX.

TREATMENT OF LATERAL CURVATURE OF THE SPINE BY THE FORBES METHOD.*

DR. Z. B. ADAMS.

Diagram I shows the course through which the vertebra travels in going from the normal position to a position in structural scoliosis. The straight line AA' connects the extremities of the thoracic curve in scoliosis.

ABA' is the curve made by the vertical axes of the bodies of the vertebra.

The plane XY is perpendicular to the straight line AA' and contains the curve described by the vertebral body in passing from its normal position to its position in scoliosis.

The ribs are the elements which move and rotate the vertebra. This point at which pressure is made upon a vertebra determines the direction of its motion. The resistant articular columns limit the motions. In the thorax these bony articular columns are longer than the pliable anterior column, composed of vertebral bodies and intravertebral discs.

It has been attempted to push the vertebra straight across the plane XY from its position in scoliosis to a position of overcorrection. This is difficult. It is driving the keystone of the arch ABA' and further, pressure on the ribs increases the spring tension of the right rib and causes further rotation of the vertebra.

Twenty years ago Dr. Bradford performed experiments on the human thorax and showed that there is no rotation without lateral bending and no lateral bending without rotation and that with the spine flexed the extent of these motions is increased.

In the treatment described by Dr. McKenzie Forbes for a right doral scoliosis, he rotates the shoulders to the right, at the same time swinging them to the right, thus getting the accompanying bending toward the left. In this position, not only is the spring tension of the ribs on the right side diminished but the spring tension of the ribs on the left is increased, which causes vertebra to rotate toward the left. By the rotation of the shoulders to the right he removes the upper buttress on which the arch *ABA′* rests. Thus the vertebra is made to move back along the curve in the plane *XY*, which curve it followed in reaching its position in scoliosis.

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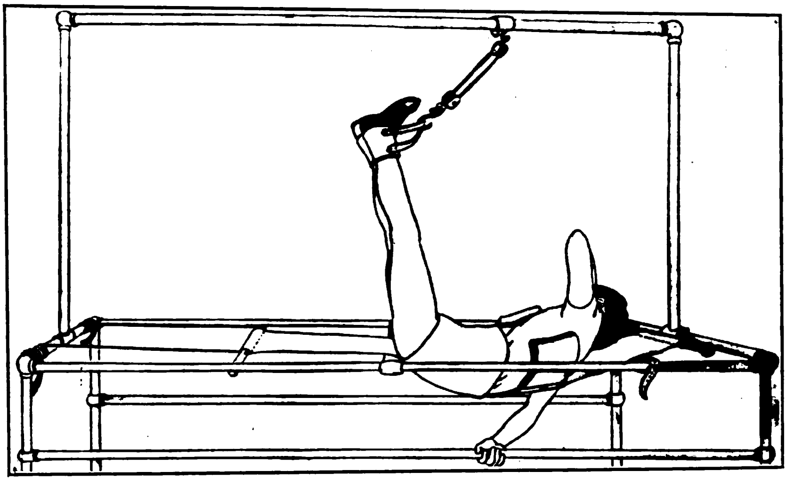
* Read before the American Orthopedic Association, May, 1913.



This shows a boy with a right dorsal scoliosis on the frame, with pads in place, ready for the application of the upper portion of the jacket. The jacket goes over the shoulders to preserve the rotation. Large windows are cut through the portions covering the pads shown, and the pads are removed.

We have treated a series of cases during the last two months at the Massachusetts General Hospital in this way, using the physiological method suggested by Dr. A. McKenzie Forbes. Records of these cases by stereoscopic photographs show a marked improvement in the rotation and lateral deviation in these cases.

The difference in the methods of Abbott and Forbes is shown by the accompanying diagram II. Abbott with the spine in flexion pulls in the direction indicated by the arrows which pull tends to rotation of the ribs toward the left, which increases the spring tension in the right rib, causing the vertebra to further rotate to the right. Forbes with the spine in flexion ro-

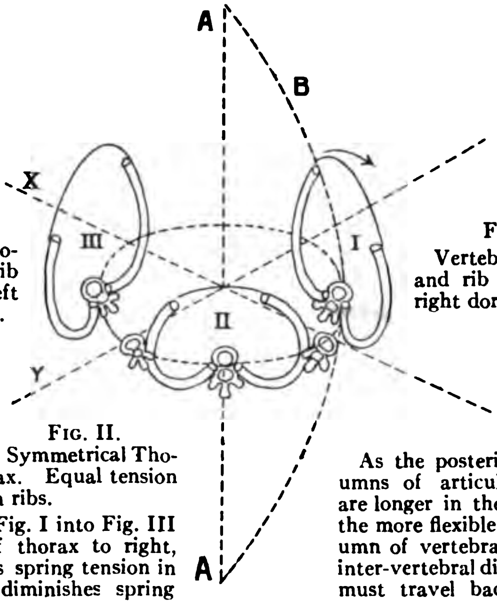


FIG. III.
Vertebral rotation and rib deformity of left dorsal scoliosis.

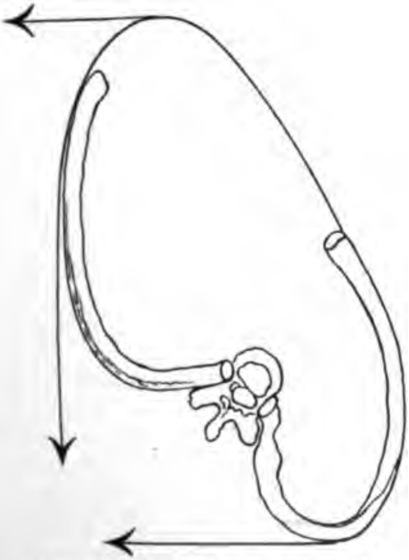
FIG. I.
Vertebral rotation and rib deformity of right dorsal scoliosis.

FIG. II.
Symmetrical Thorax. Equal tension in ribs.

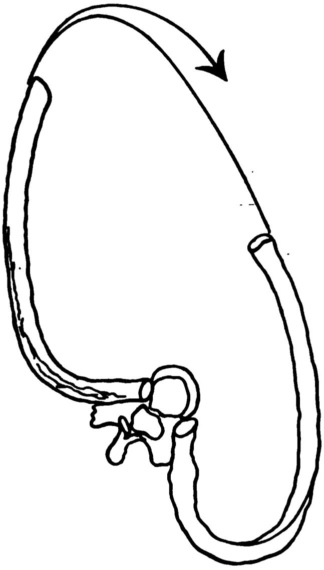
To convert Fig. I into Fig. III rotate front of thorax to right, which increases spring tension in left ribs and diminishes spring tension in right ribs, thus rotating vertebræ to left.

As the posterior bony columns of articular processes are longer in the thorax than the more flexible anterior column of vertebral bodies and inter-vertebral discs the bodies must travel back along the curve and pass through Fig. II before reaching Fig. III.

Cross Section of Thorax at Dorsal Scoliosis



Direction of the forces as applied by Abbott.



Direction of the rotary forces as applied by Forbes.

tates the shoulders to the right thus tending to restore the symmetry of the thoracic cross-section found at the point of greatest curvature. This with the lateral bend which accompanies such rotation causes the vertebra to rotate to the left and travel back along the curve shown in the first diagram, to its normal position.

The photograph is from a sketch of a boy with a right dorsal scoliosis, on the frame in a position of correction, ready for a plaster jacket.

DISCUSSION ON THE SYMPOSIUM ON LATERAL CURVATURE.

DR. WALTER TRUSLOW, Brooklyn.—It seems to me that the discussion of yesterday morning, continued this morning, has tended to show a very decided change in the attitude of most of us toward the treatment of scoliosis. That some of us may have been feeling our way toward the new principles of treatment is of no particular importance; but that Dr. Abbott has presented a decided advance in the treatment in giving us the flexed position in treating structural lateral curvature of the spine, I think, goes without comment. It seems to me that Dr. Adam's principle and Dr. Freiberg's work are not radically opposed to each other. The distinction lies between the question of whether one attacks the primary curve first, as Dr. Forbes enunciates, or whether the secondary curve is attacked, as I think is the principle on which Dr. Abbott works.

I should like to add a certain comment to this discussion, and that is to emphasize the importance of a third plane of space in which this deformity lies. We have spoken much of the lateral deformity, and much of the horizontal-plane rotation. There is also the antero-posterior plane; and if we will consider the deformity as an increase in the physiological curves—kyphosis in the upper, and lordosis in the lower part—we shall likewise see an added feature to this deformity. I think that we might begin to use the new terms. We speak of rotary-lateral curvature of the spine, and I think this term is a good one; but in the common type of this we speak of the right dorsal and left lumbar. Therefore, if we also say right kyphosis and left lordosis, we shall add a distinct element of exactness to the subject.

This picture shows the three planes in which the deformity exists. The picture on the left shows the left lateral deviation with a distinct body lean to the right; and the other, the left kypho-lordosis with a distinct body lean backward. In this picture, there is a distinct increase in the inclination of the pelvis. One tends toward the condition in which the pelvis is flexed, and that tends toward a shortening or contraction of the thigh flexors.

Here are some attempts to show the curves at the different levels. They are cross-sections, very roughly drawn. My idea is that we should correct this much first. I endeavored, through personal conversation with Dr. Whitman, to point out the similarity between this method of correction and that of talipes equino-varus. We correct a varus by perhaps even emphasizing the equinus deformity. In this correction, if we extend the patient forward or, as Abbott has done, lying in a sling, we overcome the body lean backward. If we bend the patient forward to the left, we overcome the body lean backward and to the right. If anyone gets the patient in that position, he has distinctly lessened the pelvic inclination. We have noticed these patients going around with Abbott jackets on; for the first week or so, they appear very much bent forward. After a while, however, they seem to straighten up a little bit. Now how do they do it? They will not "stand for," to use the slang expression, being bent forward; but will endeavor to straighten themselves. That will lengthen the flexor muscles of the hip, especially on the left side; because the trunk has been drawn in that direction. It is my judgment that the correction that Dr. Freiberg thought we were tending toward is the final thing. If we get the right method, it will be a two-stage process. We shall overcome these secondary conditions first; and then endeavor to overcome the main trouble, the rotation, afterward. It is merely a question as to which of these two you do first.

Dr. Z. B. Adams, Boston.—I think that I might perhaps explain the difference between Dr. Forbes's and Dr. Abott's method of treatment. Dr. Abbott puts his patient in flexion. That increases the mobility of the dorsal spine, as it separates the articular processes. Then he puts a circular strap around the thorax, just as Dr. Lovett used to do, and pulls down in this direction. Now, gentlemen, that simply increases the rotation. You must rotate in the other direction, in order to restore the thorax to its normal form.

Dr. A. H. Freiberg, Cincinnati.—This is a very interesting discussion to-day, and there are several things that I have noted as worth while to pay some attention to. First, regarding the method proposed by Dr. Cook, I think that there are several points that we must recognize, if we have had much experience in the treatment of scoliosis. Dr. Cook takes the most convenient situation for the correction of his crook—about the middle of the dorsal region, which is the situation in which the deformity is most amenable to any mechanical control whatever. It is evident to us from these diagrams that this method would be inefficient for any other portion of the spine than the one that he shows. His statement that if you correct the dorsal curve, the lumbar curve will take care of itself, is a point that is not well taken. I think that I have shown in my paper of yesterday that fixation and correction of the dorsal curve, long continued over a period of months, has failed to make sufficient change to bring about a correction with compensation of the lumbar curve. On the contrary, I think that there is sufficient mechanical ground to believe that if we confine our efforts to the dorsal curve when there is a well-marked lumbar curve, it will increase the latter, rather than the reverse, simply from the action of gravity. There is one thing that we are all likely to overlook in our enthusiasm for the correction of this deformity and that is apparent when we put the spine in the position of flexion and side-bending; and that is a thing that we have long known, but have forgotten. That thing is that we always find torsion and lateral deviation together, and have found that the torsion element of the deformity is the most difficult to dispose of. We sometimes forget that these two elements of deformity do not stand in any definite relation to each other. Anyone who has measured spines before correction and after correction knows that we find severe degrees of torsion with comparatively slight degrees of lateral deviation, and that we find the reverse almost as frequently. It is not sufficient to pay attention to the element of torsion without attending to the element of lateral deviation. It seems to me that Dr. Abbott, by attending to both, has given us an element of distinct advantage. This line of reasoning will show a lack of efficiency in a pure rotation treatment. The photographs of Dr. Forbes show both efficiency and inefficiency in this regard.

In the next place, we have heard that it is important, in carrying out the rotation treatment, to recognize the primary curve, and attack it as the principal seat of our therapeutic endeavors; but which is the primary curve? Is it easy to determine? Sometimes; but frequently it is exceedingly difficult. I have seen cases in which I could not make up my mind which was the primary curve.

I am much interested in what Dr. Truslow has said, especially since, during the past year, we have adopted a somewhat different plan of treatment for antero-posterior postural faults. We have been very well satisfied with the results of our efforts, particularly of a gymnastic character, with round backs. The frequency with which an abnormal anterior bend in the lumbar spine is associated with an abnormal backward bend in the dorsal spine is known to all, and has become increasingly evident to me by careful measurements of these cases. During the past year, we have not ignored the dorsal segment; but we have been paying more attention to the lumbar than to the dorsal, particularly by attempting to strengthen the extensors of the hips. We have made an effort to develop the extensors at the expense of the flexors, so far as possible. I am not ready to speak in terms of finality with regard to this, except to say that we are under the impression that our cases are doing better with this plan of treatment than they have ever done before.

Dr. C. F. Painter, Boston.—I hope that this discussion is not going to cease here. The subject is one that is more conspicuously before the public at this time than any other of orthopedic interest. I know that there must be a great many men present who have ideas regarding it; but who, because they are not in conformity with the latest position that certain men are taking, do not like to air them. This, however, is no reason why they should not be brought forth. In fact, it is the very reason why they should. If scoliosis is so prominently before the public as it is now, it is because we are making an honest effort to try to solve successfully a problem that has been before us all our lives. If we sit back and have nothing to say, I think that we are putting ourselves in a very unfortunate scientific position.

Dr. Shands.—I most heartily agree with Dr. Painter, and I wish to say that we shall be glad to hear from any visitors that are present.

Dr. Kleinberg, New York.—I should like to report a series of fifty odd cases that I have treated within the last fifteen or sixteen months by the Abbott method. There are a few points of especial interest in regard to them. First, all have not been cured. Out of fifty-one or fifty-two cases, however, seven have been overcorrected. Twenty-two have been markedly improved, and twenty-one have not been improved at all. In fact, of the twenty-one, four or five were given up, after persistent treatment, as cases that could not be improved; and one, and possibly two, have been made distinctly worse. I can well recall a boy of eight or nine years that Dr. Whitman saw with me, who was made distinctly worse. There was a right dorsal deformity. The rotation was increased by the treatment, which had to be given up because the boy was made worse by it and a kyphosis appeared in his back. In the course of the treatment, a few things were noted. First, almost invariably, even in the cases that were overcorrected, as the dorsal curve was improved, the lumbar was made worse. I have X-rays to demonstrate this. In only two cases out of the fifty odd that I treated was the lumbar curve improved or obliterated; in all the others, the lumbar curve was much aggravated. A common observation was that as the felt pads were inserted, the chest, in a left dorsal lumbar curve on the left side, for instance, was much compressed; and perhaps on the posterior surface of the chest the hollow had come out some, the X-ray showing that the lateral deviation had not been influenced. It is impossible to say in advance, in many cases, where improvement is going to appear. For instance, in a girl of twenty years with a severe right dorsal left lumbar curve, improvement was obtained. During a period of fifteen months, she has secured marked improvement. I recall a girl of seventeen years whom I have treated from the first with the Abbott method, and she is not one bit better than when I started. It is interesting that we can improve some cases, and can cure many; but that there are many that are not amenable to this form of treatment.

One other important point is that the lateral compression, the insertion of felt pads on the side of the chest in an attempt to overcome the deviation, in my opinion, does very little good. I have often noticed that when the chest was flat on the right side in a right dorsal curve, it was flatter, if anything, when I was through with the treatment. We have to depend a great deal, as was impressed upon us by Dr. Whitman, on the posture. The breathing has a good deal to do with the cure also. That is, with limitation of the expansion of the chest on the left side of the front, the chest will expand somewhere else. The expansion will take place on the left side in the back with compression on the front. From the cases that I have treated, there is no doubt in my mind that there are many forms of deformity, especially high cervicodorsal deformity, in which we have no success whatever; and even with severe lumbar curves, I have had very little success. It seems impossible to influence in any way that curve. I have cut out the hips over the right side in a left dorsolumbar curve, and attempted to shape the pelvis; but the X-ray showed very little correction of the left lumbar curve.

Dr. Michael Hoke, Atlanta.—It seems to me that some methods named after the men who have devised them fail to give satisfaction in the hands of some others, because other men try to apply these methods universally to a given class of cases, without carefully differentiating between the details of the given cases. A man comes along and says that he treats his cases with the Abbott method, for instance, and has obtained splendid results in the first fifteen or any certain number of cases, and then notices that in the others he does not get the desired result. I think that in such instances the criticism should not be against the method, but against the way in which the man is using it. He should criticise himself. He should ask himself whether he has appreciated the mechanical details accurately enough to apply his mechanical forces of correction properly. The comparatively recent evolution of the treatment of Abbott involves several things: the fact that you can bend the spine, provided it is unlocked; that you can change the shape of the thorax almost at will by unlocking the spine and applying corrective forces; and that by removing pressure from the chest where it is hollowed, you can cause it to fill out. We have got that far. It seems to me a good thing to advocate the rotation treatment, or the breathing treatment, or fixation and lateral pressure treatment of scoliosis; for all these elements come in. You have to apply different forces to different parts. In out criticisms, we should not attack the method; but we should utilize the good in each method, and criticise our own individual efforts and improve our ways of applying these things.

Dr. John Dane, Boston.—I wish to compliment Dr. Meisenbach for having drawn our attention away from the side of the spinal deformity and toward the side of the deformity of the trunk and thorax in scoliosis. We have been accustomed to regard the bony deformity, and have neglected some of the symptoms which I have found the result of the bony deformity. We have all known, for instance, that the liver and lungs, as well as other organs, may be cramped by the position of the spine; but I had not previously looked for the smaller functional troubles of scoliosis. One might have expected to find these because each nerve has two branches, which are distributed, respectively, to the back and to the thorax or abdomen. I believe that it is impossible to have any irritation around the dorsal branch without having a reflex sent to the anterior branch, affecting the organ to which that branch goes. Bronchial, stomach, intestinal, and all sorts of functional troubles come from scoliosis, and need to be helped in even the slightest grades of scoliosis; so I think that Dr. Meisenbach is on the right track.

Dr. G. G. Davis, Philadelphia.—It being known that flexion contributes to the correction of the spinal deformity, the question then arises as to means of obtaining that correction. Now the primary apparatus of Dr. Forbes is a very complicated one, and the question that comes before us is as regards the means we shall use for this purpose. We have three different methods already published: the Abbott frame, the frame of Dr. Forbes, and that of Dr. Adams, all three of whom are using different appliances for the same object. Dr. Elmer, in my clinic, is trying to accomplish the same object with the patient in a sitting position, using two uprights with a seat, to which the patient is strapped. Then the patient is put in a flexed position and twisted, with the hands supported on side projections. The pelvis is fixed by one part of a plaster bandage. The upper portion of the trunk is then twisted so as to obtain the greatest correction; and the second part of the plaster bandage is placed on it. Since coming to this meeting, I have found that another member of this Association, who, I hope, will discuss this subject, is likewise working on the question of correction with the application of the jacket in the flexed position, with the patient sitting, instead of lying down.

Dr. S. M. Cone, Baltimore.—I should like to tell you of a case that will clearly illustrate Dr. Porter's paper on the Prognosis in the Treatment of Lateral Curvature, the prognosis in this case being influenced by the etiology. A patient with extreme left lumbar curvature came under my supervision a short time ago, and we were in doubt as to the cause of the curvature. The patient had previously been in the hands of a medical man for some time, and he said that he could not do anything more, after having tried electricity for the relief of pain, which followed the course of the ileohypogastric nerve. We put the patient to bed, after having taken an X-ray, and had a nerve specialist go over the case. We found the pain localized over the right kidney, and the X-ray showed a shadow on the right side with an acute bend. We thought that the kidney was in fault, and had it catheterized; and we found a little albumin and a few pus cells. We also discovered that there was a sharp kink just above the fourth lumbar vertebra. Dr. Hunter said that there was something in the abdomen. The X-ray had shown nothing in the bones, and the therapeutic tests had excluded tuberculosis in the spine. There was no psoas abscess, evidently; so we wondered what the shadow was on the right side. The possibility of fecal impaction was suggested, and we determined to go in and find out what was there. We knew that there was something. We did so, and found a chronic appendicitis with impaction of the colon. That shadow which appeared in the X-ray showed every time a picture was taken, and was mistaken for a possible psoas mass, turned out to be an impaction of the colon. This condition had gone on for two years, the pain being excessive toward the end. I waited two weeks before making another examination, and then found that the scoliosis had completely disappeared. This is the interesting point in the case.

Dr. Compton Reilly, Baltimore.—I hesitate to discuss this question at the present time, because I am still of the opinion that I held ten years ago; and that is, that the starting-point of scoliosis is in the pelvis. I think that it starts with a twist. I showed this at that time. With the patient in the standing position, the arms folded, I demonstrated that often, when there is an apparent difference in the length of the legs, by actual measurement, there is not. I also showed at that time some photographs of myself, standing with one foot raised high by being placed on several books, and bending forward. The picture showed the rotation and curve in my spine produced by this attitude. I cannot show the curve of the spine in the doctor, but I showed it in the photographs; and that was the position that I was standing in. I have been using the same apparatus that I use for the spine in Pott's disease, to correct the deformity in these cases; I believe that Dr. Truslow has modified that apparatus, and I have been following him. I do not know whether he tilts the seat and fastens the sides down. I do this, and then the patient is twisted. I believe that the time is coming when we shall use no apparatus for the application of the jackets in lateral curvature, but will simply prop up the foot that is apparently short, have the patient bend forward, and apply the jacket in that position without any forcible apparatus. I have been working along this line, but am not reporting any cases at this time, because I do not feel that I have carried my work on long enough.

Dr. David Silver, Pittsburg.—In the use of any new method, I think that we are apt to forget what we have done before. A few years ago, there was a good deal of work done on increasing spinal flexibility. I should like to recount one case out of the number that I have treated by Abbott's method, which showed me the importance of flexibility of the spine. There are a number of cases that have rotated very easily, and the method to me has been a great satisfaction. A great deal of improvement has come from it.

This particular child was ten years old, and had worn a straight removable jacket for some time under other hands. I applied the jacket as nearly as I could according to the Abbott method, I having seen him work, and the first X-ray showed a considerable improvement, but with a rather marked angular deformity of the ribs. This was not quite satisfactory, so I later applied another jacket. I applied about four jackets altogether, and the final one satisfied me. It was so arranged that the spine was beautifully flexed and rotated. The shoulders were high, and the ribs on the affected side were very prominent, instead of being depressed. The result was all that I could have asked in the way of apparent overcorrection. On removing the jacket, we found that while the patient was markedly improved, the spine had not entirely rotated and was very stiff. I took off the jacket and placed the child on the right side; and then the child's farther, who was a physician, began to treat her to increase the flexibility of the spine. I saw her a few weeks ago, and she showed a marked gain with this removable jacket. I have been using that method to increase the flexibility in these stiff cases, removing the jacket morning and evening to allow the patient to take the exercises. That is something that we should not forget. We cannot take stiff cases, especially of paralytic curvature, and rotate them easily. We must concomitantly use the exercises and movements to increase spinal flexibility.

Dr. Kleinberg, New Yoik.—If I may refer to the remarks of Dr. Reilly, I should like to mention in connection therewith a case of right dorsal left lumbar curve that I had overcorrected. I had decided to make a removable corset, and did so while the patient was standing up in the flexed position; and it was easy to overcorrect and make him remain in that position by his own muscular effort. I put a corset on in that position, and the correction showed afterwards; for he could retain the overcorrected position. The only difference between this and Dr. Reilly's case is that this patient had been overcorrected by the Abbott method originally.

Another point is the question whether the lumbar curve is associated with any pelvic deformation. In a series of pelves that I examined at the College of Physicians and Surgeons, there was a distinct deformation shown by measurement in the pelvis that was accompanied by a lumbar curve. Now, whether every lumbar curve is accompanied by deformation in the pelvis, I do not know; but in a series of twelve cases, there were three or four in which there was a difference between the measurements on the two sides from the posterior superior to the anterior superior spine of the ileum.

Dr. S. J. Hunkin, San Francisco.—Since this is a day that we are giving personal experience, I should like to give some of mine, which is a little different from the kind that has been expressed here. We are making jackets by having the assistant stand on a platform 2 feet above the floor, with his back against the wall. A frame, the width of the patient, moves up and down on a perpendicular guide, and the patient is fastened to the frame. A nurse sits at the foot of this frame, keeps the patient covered with a sheet, and sees that one foot does not come lower than the other. A pad is put under one of the legs, and is adjusted until the pelvis is squared. Then the nurse takes the patient by the shoulders, and side-bending and flexion are produced by the assistant until the deformity is obliterated. Where there is great rigidity, the man who is standing 2 feet above the floor has full control of the patient's spine. Then the jacket is put on in that position. No force is applied to the patient. The rotation is easy, and the jacket is put on in a few minutes. Where there is great rigidity, we have difficulty; but if the patient will flex the spine, we have full control of the side-bending.

Dr. H. Augustus Wilson, Philadelphia.—I have been profoundly interested in the whole discussion, and especially by the absence of any plan of accurately recording the conditions prior to the correction and after correction. I have been particularly impressed with the danger in relying upon radiography as a means of recording the conditions before and after treatment, because I have been most thoroughly deceived by cases that showed apparent physiological cure with good function, and yet in which the rotation was apparently as conspicuous in the X-ray after correction as before. In these cases there were improved posture, improved flexibility, and improved hygienic conditions. I do not know how this matter is going to be overcome, unless we all fall at the feet of Dr. Freiberg and study accurate methods of recording degrees of scoliosis besides radiography. We are at present without a standard to judge our results by. The patients will judge them by their personal feelings, and their parents will judge them by their children's capabilities; but in this discussion there seems to be a lack of uniformity in this respect, to which I will direct your attention with the hope that in a subsequent discussion we may try to know accurately the conditions before, during and after treatment, and to be positively informed as to the real changes that have taken place—not in function or in appearance, but in measurement.

Dr. E. G. Abbott, Portland, Me.—There are one or two points that have been called to my attention in this discussion in regard to which I should like to say something. In the first place, it does not seem to me that it makes any difference what kind of apparatus a man uses, so long as he can place his patient in the proper position by means of it. That is the position of flexion and lateral bending, with elevation of one shoulder and depression of the other. You must bear in mind, however, that if you have a lumbar curve, it is necessary to put on an additional strap, to make your traction and rotation there. I thoroughly believe that it is possible to under-rotate the lumbar spine, perhaps as easily as the dorsal spine. In quite a few cases, the curve is confined entirely to the lumbar spine, and then you must direct your whole attention to that part. You must also bear in mind that you must be careful that, in doing that, you do not develop a curve in the dorsal region, which must be held by a strap and prevented from bending laterally or becoming crooked.

Dr. John Ridlon, Chicago.—I have refrained from making any remarks until now, because I did not know anything about the subject. I have treated lateral curvature all my life, in all the patients that came to me, and have cured two or three before, and perhaps some since, the introduction of the Abbott jacket. I think, however, that we know very little more now about the treatment than in the past. I have not a word of advice to give, except to treat the cases as they seem to demand. It is as absurd to treat all cases in any one way as it would be to go out and buy spectacles from a fellow on the curbstone for ten cents a pair.

Dr. B. E. McKenzie, Toronto.—This discussion is hardly, I think, a discussion on lateral curvature, broadly taken. It has resolved itself into a discussion of the mechanical treatment of lateral curvature; and I do not purpose, at this time, to introduce a new element into it. Personally, I consider it much more important to treat the patient than it is to treat either a curvature or a bow-leg. That is, I think that one should hold constantly in mind the fact that one is dealing with an individual, and not simply with a deformity. I think that we can still further limit the discussion. I hope that the remarks of those who have spoken have not had reference to what we call postural deformities, which, by simply coaching the patients, instructing and teaching them in front of a mirror, can be corrected by the efforts of the individual. I would completely exclude mechanical treatment by any form of brace or jacket in such cases. As for myself, I consider that the treatment, as presented here, has referred to a certain class of cases, and is purely mechanical, having to do with structural deformities alone. In any case, if we can keep ourselves up to certain principles that have been enunciated, we are safe in confining ourselves to the application of these principles.

In the first place, we had a paper by Dr. Cook, and he certainly gave us one principle that is sound and universally applicable, and which we need not discuss. It is that if you correct any one part, whatever it may be, and place the individual in a natural position, by whatever means you are able to, if this means be not injurious, you thereby tend to bring about the operation of Wolff's law and a natural, complete and radical restoration of normal conditions. That principle is sound.

Then Abbott has enunciated another principle, which perhaps was not original with him, but was certainly new to me in practice. In practice, I had constantly set myself in opposition to it, which was wrong. The principle is that if you flex the spine, you set free the locking elements behind the articular processes and make the spine movable, which before, by hyperextension, you were blocking and preventing, and are thus able to get rotation.

One thing more: By the way, too, under the direction of my assistant, we are using the Abbott jacket—a more mechanical treatment than I have ever used before, because my assistant went to see Abbott and other men using the Abbott treatment, and came home very enthusiastic about it. We are satisfied that in the difficult structural cases it is of great benefit. Indeed, so far as I have seen mechanical methods of treatment, I think that Abbott has given us the most successful mechanical means for grasping and correcting the curvatures of the spine and of treating deformities of the trunk from a mechanical standpoint.

I think that one or two things that have been said ought not to go unchallenged, because I believe that the speakers did not mean what they said, or were going east when they intended to go west. I mean to say that in the discussion of the deformity, one of the essayists showed a cross-section of the chest and said that this is the direction to go in order to correct the deformity. I say that the man who tells you that is going east when he expects to go west. It is true, if he limits himself to pressure in this direction and tells you that this will increase the lateral deformity of the chest, he is right; but that is not where any man would attempt to apply it who had a correct notion of mechanical principles. He would apply it against the angle of rotation, the angle of the spine, and press it in this direction. He would have a certain amount of pressure in a backward direction, and would correct the deformity of the rib wall, and of the vertebrae, at the same time.

DR. JAMES K. YOUNG, Philadelphia.—Before the discussion is completed, I should like to make one or two remarks. We have been using the Abbott method a short time, and on a few carefully-selected cases. I am much pleased with the method in the treatment of the rotary form of lateral curvature. It was my custom, years ago, to treat the mild cases by exercise and I have placed myself on record in that way; but the introduction of the Abbott method led me to adopt it. I am much pleased with the results obtained from it, but the cases must be carefully selected. Everything else must be eliminated, and the age of the patient is also an important question. A patient of twenty-two years, for example, does much better than one of fourteen or sixteen. This is very important.

With regard to the method, I think that the mechanics of it is this: The spine is fixed and rotated; the pads are put on one side, the side is fixed, the respiratory movements are carried out, and the other side is freed from pressure by cutting out over the pads. There is a slight danger, that of producing sloughs. We have had one very extensive slough, which appeared with the treatment; and I do not know whether or not it contributed to the death of the patient.

We have been making some special experiments this year. Dr. Oscar

H. Allis and I have made some discoveries; but he has asked me not to speak of them, because he has almost completed his book, which will contain references to them. He discovered the method of untwisting the spine by twisting the pelvis.

Dr. Ashley, New York.—I did not expect to say anything at all on this subject, and do not feel that I can do it justice at all. I will say, though, that I have been trying to do this work for the last year or two, and think that I have learned something, although not so much as I should like to. I believe that we have a pretty good start on the subject of scoliosis, which we have never had before; but we have not learned all about it. There are many things still to learn. I should like to state to you what I am trying to do now.

I feel that my inefficiency in technic is largely to blame for my not having accomplished what I should have liked to accomplish; and I have really been surprised that the method has not been found fault with more here, because of that very point. I believe that there is a great deal in the technic for every man to learn. I would just say, regarding my younger patients, that I find that those that are growing are the ones that I can do the most with. Some of my younger patients, I have kept the jackets on for a considerable length of time. I have one in overcorrection, as shown by the X-ray, but not as shown by the physiological curve or the appearance on looking through the jacket. It took me sixteen months to really overcorrect a patient who had a very well-marked rachitic curve, a child of eight years. She was rather delicate and an only child. She complained considerably, and I had to go carefully with her. Another child, her counterpart, it has taken ten months to correct. I have found others, girls of sixteen to eighteen years of age, that are very small and thin-ribbed, who it has been impossible for me to correct. They have very elastic ribs, which would bend so that I would have apparent correction; but, as has been mentioned before by Dr. Kleinberg and others, when we put the X-ray on these cases, we found that we had but little modification of our scoliosis.

I do not, however, want to complain of the method in saying this. I think that it was the kind of case and my technic that caused the failure. As to the cases in persons twenty-two or twenty-three years of age who have very mild curves, I am not advising them to take this method of treatment, and when thay are twenty-three to twenty-eight years old and have a severe curve, I never attempt it.

Dr. H. P. Galloway, Manitoba.—There is one suggestion regarding certain cases of lateral curvature that I should like to make. We all meet with certain cases in young children with considerable deformity, especially cases due to poliomyelitis; and we have all watched them growing worse, year after year, and felt the difficulty or impossibility of controlling them. One of these was in my office a few months ago, and I have had the same experience as others in laying the child on its face and noticing the deformity almost disappear. I have had, during the past year, considerable experience with bone grafts in the treatment of Pott's disease and I thought it possible that I could produce a fixation of the spine in such children by means of bone grafts, and that this would be justifiable. I have not, however, had the courage to try it yet. I think that I shall get my courage screwed up to that point soon. I believe that the experiment would be justifiable, and the family of one patient are willing to have me perform this operation, if I reach the point of recommending it. If, by placing the patient in the recumbent, or any other position, we can get a great improvement in the deformity, I do not think that we should be doing a great deal of harm by fixing or solidifying the vertebræ in that position. There would result no worse condition, certainly, than the child would have if allowed to grow up with this deformity constantly getting worse and producing all the disastrous effects that accompany these severe cases. I hope that someone will try that method of treatment.

Dr. Robert Soutter, Boston.—I should like to put on record at this time the work that is being done in the Children's Hospital at Boston with the very bad structural cases, through a method of traction on the head and corrective gymnastics, by Dr. Sever. His work has been so wonderfully successful in these difficult structural cases that I think that we should have a record of it here at this time, and perhaps ask him to tell us something about it.

It seems to me that in criticising Dr. Abbott's method, which has helped us so much in lateral curvature, I have very often found that in putting an Abbott jacket on an extremely difficult case, it takes approximately a second and a third jacket before I can say that the method has been tried in the way that it should be. I often find in putting on the third jacket, that I can get a correction that I could not get in the first or the second. There are many cases in which I have not been able to get any results, however, and in these the older methods of pressure, gymnastics and extreme force have frequently given good results. But where the Abbott method may be used, it certainly requires less force and a much shorter time to obtain correction.

Dr. Root, Hartford.—I should like to emphasize the point with regard to the older and stiffer cases. I think that you will get the same results, if you will give a proportionate amount of time to them. There are some cases that we get in which I find good results from a few jackets; but there are others that are hard to fix, and these must be attended to. I make it a rule to put into the hospital all my cases now. There the patients can be reëxamined each and every day. Those in which the curves are hard, I have put in the Abbott frame every day and stretched. By the breathing method, we find that we can accomplish a great deal.

We institute breathing exercises, giving three special exercises a day. In regard to abrasions and sloughing, I think that these are unnecessary, if we watch our cases. They should be watched every day and exercised. Change the jacket every week, if necessary; and put the patients through various exercises with the jacket on and with it off. They will thus get in one or two months, what desultory work would have taken two or three years to accomplish, and what perhaps would never have been accomplished in that way at all. By constant attention, I have accomplished in one month what in other cases I have worked for two or three years to obtain, and then often secured little improvement. Of course, this kind of treatment means hard work; but in all these cases you can get fine results by this constant hard work. Do not apply the jacket, and then not see the patient for a week or two; for you cannot expect to find them improved, if you do that. If we work carefully, we will get results; and if we do not, we will not get them. I do not think that the improvement is all the result of any particular method, or that any particular method is at fault when there is a poor result. It is up to us to use our tact and apply all the methods by a combination of which we can get the best results.

DR. J.E. SEVER, Boston.—It seems to me that Dr. Hoke and Dr. Root have both presented the same facts here. We are going through an experience meeting and talking about beliefs, and not facts. We are not keeping a sharp line of demarcation between what we think are facts and what we know are beliefs. Lateral curvature can be helped by any method, whether the jacket is put on in flexion or in suspension. I have had more experience with the head suspension; although I think that the flexion is mechanically better, and that you can get better correction with it. I consider it immaterial, as Dr. Abbott has said, what sort of apparatus you use, if you get flexion. The apparatus devised by Dr. Adams is adequate and sufficient. Of course, the simpler the thing is, the easier it is to put on a jacket; and, as the consequence of that, the better is the result that you get.

I am much interested in the discussion. I should like to suggest that we have a symposium next year on the same subject. Then let the men who have methods, such as Freiberg, Forbes, Abbott, Cook and others, use them from now until that time, so as to be able to report to us next year facts, and not beliefs (applause).

DR. ANSEL G. COOK, Hartford.—I have no new method, but the mechanical use of an old method.

DOCTOR A. MACKENZIE FORBES,* MONTREAL, in closing the discussion on the Scoliosis papers said:

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* Owing to lack of time no opportunity could be given for the customary closing remarks. So many questions appeared in the discussion by other members that it seemed wise to ask Dr. Forbes to make reply to these questions in order that so many unanswered queries should not appear in the reprint of the meeting.—The Editors.

As several questions have been asked and several remarks made about the form of treatment of scoliosis by rotation suggested by me I would like to close the discussion, insofar as my paper is concerned, by making the following remarks:

I was interested to hear Dr. Truslow's suggestion that the form of treatment suggested by me differs from that of Dr. Abbott in that Dr. Abbott attacks the secondary curve first and that I attack the primary curve first. I am not prepared to criticize Dr. Abbott's method but I feel sure that it is but rational to attack first the primary or organic curve allowing, as far as possible, the secondary or compensatory curves to look after themselves. I am under the impression, as Doctor Adams of Boston appears also to be, that Abbott rotates in a direction opposite to that in which I rotate. If, as Dr. Truslow suggests, the principle of treatment by Abbott is to attack the secondary curve then an interesting explanation has been suggested as to why treatment by Abbott seems to absolutely differ from the treatment suggested by me and why it seems that the only point of similarity is that we both apply treatment when our patient is in the flexed position.

Regarding the words of Dr. Z. B. Adams of Boston. Dr. Adams is the ablest exponent of the form of treatment which I have suggested. As Dr. Truslow has inferred Dr. Adams has said, evidently Dr. Abbott in treating scoliosis rotates his patient in exactly an opposite direction to the direction in which I rotate patients being treated by me.

The discussion by Dr. Frieberg of Cincinnati has interested me very much. He says that the torsion element of the deformity is the most difficult to dispose of. I do not know that I agree with him in this. It depends on how one goes about trying to dispose of this torsion. If one tries by rotating in the wrong direction as a good many have done in the past then it will be found hard to dispose of torsion. Again Dr. Freiberg says we sometimes forget that these two elements of deformity (rotation and side bending I think he means) do not stand in any definite relation to each other. Now is he right? Side bending means approximation of the rib wall of the convex side to the body of the vertebræ and rotation of the vertebral body toward the narrowing rib wall. Probably there is a definite relation between the two. The manner of attachment of the ribs to the vertebræ would suggest that there is and if there be then is not Dr. Freiberg surely wrong in his suggestion that there is a lack of efficiency in "a pure rotation treatment" because rotation is accompanied by side bending just as side bending is accompanied by rotation. Do not the skyograms which I have shown show this?

Treatment should aim at attacking the primary or *organic* change. True it is often difficult to say which this is but to-day with X-rays at our disposal we ought to be able to come to some conclusion.

Dr. Gwilym G. Davis of Philadelphia complains that the apparatus used by me is complicated, but I am not advertising a form of apparatus but rather preaching a new doctrine regarding the mechanics of scoliosis and I have distinctly said "the charms of this form of treatment lie in the fact that each step undertaken can be thought out and a reason suggested for every move, and that anyone can *produce correction* (by the rotation method) *without apparatus* and simply maintain the same by the use of plaster of Paris." I employ a "more or less complicated and continually evolving apparatus in order to secure the greatest possible rotation. Dr. Adams of Boston uses no very special apparatus and yet can show most gratifying results."

I have been interested in the words of Dr. Augustus Wilson of Philadelphia. Truly we have not solved the problem of how to best record our progress in the treatment of scoliosis. Dr. Wilson has been impressed with the danger of relying on radiography but, if scoliosis is a deformity of the thorax and not the spine alone, and if there is a definite relationship between the position of the rib wall and the position of the spine, can we not place a good deal of confidence in a carefully taken skyogram?

Dr. McKenzie of Toronto challenges "one or two things." I gather that he thinks that Doctor Adams and I believe that we are going east when we are going west. In other words that those who use this method rotate in the wrong direction. In this belief I must disagree with my friend, Dr. McKenzie. The mechanics of scoliosis are so complicated that it was almost unfair for me to promulgate new and strange doctrines without in some way preparing those who were courteous enough to listen to them.

Doctor Galloway's words strike a cord in me. I have already suggested in my paper that some scoliotics will require further control after the reduction of their deformity. For these I have suggested bone grafts. I am glad that he has been similarly inspired and I hope that a Canadian will be the first to perform this operation.

X.

GYMNASTICS FOR CRIPPLED CHILDREN.

BY MIRIAM TOWNSEND SWEENY,

Director of Physical Training at Industrial School for Crippled and Deformed Children.
Boston.

The giving of gymnastic exercises to crippled children may seem to some as preposterous as requiring a swimmer to propel himself in a vacuum. Certainly to those to whom bodily exercise means simply long cross-country hikes or tumbling around on the football field, or the acrobatic performances demonstrated by the German Turners it would seem out of the question to expect the crippled child to reap any benefits or to be in any way a candidate for participation. On the other hand as exercises may also come to mean any movement, or set of movements, which bring into activity the body as a whole or in part, we can readily see wherein the crippled child may indulge those parts which may be beneficially active, and yet not sacrifice the effected part. As the general aim in gymnastics is health, it is natural to suppose that if correctly applied, gymnastics may be as influential in dealing with crippled and deformed children as they have proved to be in dealing with the normal healthy child.

Gymnastics are divided into two kinds, educational and corrective. Educational or hygienic, that type which is constructed upon physiological principles and corrective or medical, that type which has for its working basis pathological consideration. It is through the latter variety that we reach the crippled child.

We may not expect these children, handicapped as they are by physical defects, and by apparatus of various kinds, to be in line for exercises requiring quick response, up to a certain point, skill and balance or any of the finer qualifications which the normal child acquires in the gymnasium.

There is with the crippled child a definite pathological condition, and the chief aim should be to adjust the child physically so that its vital resistance be increased, and its activities normalized as far as possible. Therefore, it would be judged more effective if these children are dealt with through a series of especially prescribed exercises, based on the relief of the abnormal conditions presented in the individual. These special exercises under ideal conditions should be part of the daily routine of school. Each child should have at least fifteen minutes concentrated effort directed toward his special need and carried out under the close supervision of a trained person. It has been found that the best results are in this way obtained. Beside the localizing work on the special conditions present, effort should be made to improve in general the chest capacity and thereby the circulation. Improvement along these lines tends to lessen the predisposition to disease, and these two things alone are in themselves important items in dealing with the child already so definitely handicapped.

There is another point of view in working out the hygiene of these children. While our main efforts may be directed toward active work there is in large measure a portion that cannot do active work. For these children there should be systematic, supervised rest periods. These periods of rest being as important to these children as the periods of activity to those who may participate.

In most of the large cities to-day we find either institutions or special classes, and sometimes both, provided for the care and education of the crippled child. These children are of various types not so widely divergent from the normal as might be expected. There is, however, much difference relatively in their ages. The average boy or girl of twelve years will be finishing the grammer school, but the crippled boy or girl at twelve may be only as far as the fourth or fifth grade. This varies naturally with the amount of set-back of starting that the physical condition has enforced. Morally they are average, though they more frequently show tendencies which are reflected from the high-handed free license they are allowed at home. We are confronted, therefore, with practically the same problem in dealing with the crippled child as in dealing with the normal with the one exception thus far of their physical differences. The fact of this similarity is an important feature.

These children have various affections which presented in tabulated form may be considered as follows:

- Paralysis.
  - Spastic. Infantile. Obstetrical.
- Tubercular hips—old and active.
- Tubercular spines—old and active.
- Tubercular joints—old and active (tumor albus).
- Congenital hips.
- Congenital abnormalities, malformation.
- Rachitic deformities.
  - Knock-knees.
  - Bow legs.
  - Scoliosis.
- Traumatic amputations.
- Arthritic joints.
- Kypho-scoliosis.

The apparatus worn to correct and alleviate conditions offers hindrance to perfected gymnastic work. We are, therefore, to add one more limitation to our list, the pathological condition and the apparatus worn. Such apparatus is of the usual type. Tubercular hip splints with and without traction, plaster spicas, plaster casts for backs and joints, convalescent splints, back braces for tubercular spines and curvature cases and the usual splints used in paralytic cases.

Now that we have before us in a general way the problems which are forced upon us when we consider the gymnastic training of the crippled child, we may consider the ways and means of overcoming these problems by proceeding along the lines which are to bring into effect our final results, the health of the crippled child. Therefore, we may consider the method of treatment by exercises. In working out this treatment by exercises we are, in institutional work limited by time. For the child having routine arrangement of the following kind, mornings given to graded school work, afternoons for industrial or vocational interests, we find the day well filled.

However, certain periods of recreation are inserted and if necessary one of these periods could be devoted to physical exercise. Fifteen minutes so especially directed and carried on daily under supervision is an ideal arrangement and in most cirricula a place for this should be found without difficulty.

At the start we must recognize one important fact, and be satisfied to abide by it. Gymnastics in these cases will not cure. They will palliate and improve the general condition. They will relieve the liabilities of disease by improving general tone of body, but they cannot obliterate the conditions which are generally of a fixed type. Often as in the tubercular affections to improve the general condition is the direct way to eliminate the process. Therefore, gymnastics may be largely influential in helping toward a cure. It is along these lines then, that we must proceed.

Following the few general remarks that have been made as to the course of treatment we have used, will be given a prescription containing typical exercises which may be used under specified conditions. They may be modified to suit varying conditions and also in order to hold the interest of the participant it is advisable to replace given exercises by others of the same type.

Cases of spastic paralysis should combine coordinative work with precision exercises. Also do those things which build up the general condition and improve the circulation. Special stress may be laid upon the latter as the circulation is usually poor. Here the normalizing of activities is an important thing. It is quite possible, as has been found, to instruct the spastic child to dance with good results. This favors independence and makes them lose self-consciousness.

They should not do any exercises that bring into contraction the already contracted muscles.

Prescription—girl ten years old—spastic paralysis. General slight spastic condition present—wearing no apparatus.

1. Standing at window, stick raising forward upward with deep breathing.
   Position: At window, standing in as nearly correct normal position as possible, hands with the shoulders apart grasping stick.
   Exercise: Arm raising forward upward over head with inhalation, sinking forward downward to starting position with exhalation.
2. Sitting double arm extension upward with pressure.
   Position: Sitting on stool in erect position hands at shoulders, in bent position.
   Exercise: Arm extension slowly upward to stretch position and return. Operator resisting movement in both directions. Elbows should be carried well back and correct position maintained throughout the movement.
3. Balance walking.
   Position: Standing in correct position hands on hips, bean bag or book on head.
   Exercise: Walking may be done with or without slow knee bending and stretching. Rhythm important, the precision of the step should be emphasized.
4. Hanging.
   Position: Over-grasp of bar is preferable, feet just off floor, knees straight, head well up, hands well apart.
   Exercise: May be done straight, with all joints in extension, or may be accompanied by knee upward bending. Alternately upward bending in given rhythm is good.
5. Corner position may be done in corner of room or through a door.
   Position: Stand at arms length from wall, arms raised forward and placed against wall, correct standing position important.
   Exercise: Rise on toes, fall forward against hands into

corner. Deep breathing, avoid hyperextension in lumbar region.

6. Reach support standing, head bending backward with resistance.

   Position: Standing opposite a wall, hands placed against wall shoulder distance apart.

   Exercise: Operator gives a pressure on back of head resisting backward movement. Pressure may be given at the same time on the abdomen to prevent consequent hollowing of lumbar spine.

7. On table, hands clasped backward, trunk raising with arm extension downward.

   Position: In prone position on table, feet strapped down, hands clasped back of waist.

   Exercise: Trunk raising with arm extension downward, hands still clasped. Hold a short time and return to starting position.

8. Breathing on plinth.

   Position: Lying on back, knees hooked over end of plinth, arms bent, elbows well into sides, hands clasping operators.

   Exercise: Deep breathing as operator pulls arms slowly in stretch position. Returning arms to side with exhalation.

9. Bend standing, arm extension sidewards and upward in rhythm with dumb-bells.

   Position: Erect standing position, arms bent to shoulders, hands grasping dumb-bells.

   Exercise: Arm stretching alternately upward and sideways in given rhythm.

10. Wing standing, chest raising with head bending backward, deep breathing.

    Position: Standing at window, hands on hips.

    Exercise: Deep breathing with head bending backward.

Infantile paralysis presents different problems. Most of these cases wear splints which are too complicated in adjustment to enable us in our limited time to remove. Also removing the splint often makes the child helpless and as independence in the individual is essential in dealing with a number of cases at the same time, it is not practical to so limit them. We, therefore, leave the splints on and these cases can do much toward developing the paralyzed muscles by concentrating their efforts on those parts regardless of the splints. Unlocking these splints at the knee joints enables the child to flex and extend. Again the general developing work comes in and special stress laid upon improvement of the circulation.

In these cases as with the spastic cases we avoid contraction of antagonistic muscles and any motion which increases existing deformity.

Prescription—boy ten years—infantile paralysis of both legs wearing double calliper splints, cannot walk without splints.

1. Sitting, arm raising sideways with dumb-bells and deep breathing.
   Position: Sitting on bench, hands at sides with dumb-bells.
   Exercise: Arm raising sideways to shoulder height with inhalation—sinking to sides with exhalation.
2. At pulley alternate leg raising forward.
   At pulley alternate leg raising sideways.
   Position: Standing, back to pulley, hands on hips, leg attached to pulley rope—good standing position.
   Exercise: Alternate leg raising forward against weight.
   Alternate leg raising sideways against weight.
3. Hanging. See Exercise No. 4, spastic group.
4. Corner. See Exercise No. 5, spastic group.
5. On table—hands clasped backward, trunk raising with arm extension downward. See Exercise No. 7, spastic group.
6. On table—hands at shoulders grasping dumb-bells. Trunk raised arm extension sideways.
   Position: On face on table, elbows bent and well back, hands grasping dumb-bells, feet strapped down.
   Exercise: Trunk raising with vigorous arm stretching sideways. Trunk is held in raised position throughout arm extensions.

7. Rest sitting, chest expansion.
   Position: Sitting on bench, hands behind head, elbows well back, careful not to hollow back during exercise. Support should be given by the operator.
   Exercise: At inhalation arms are lifted up and back returned to starting position upon exhalation. Good pull should be given to gain the desired pectoral stretch.
8. Reach support opposite standing, head bending backward with pressure and resistance. See Exercise No. 6, spastic group.
9. Any of the numerous free standing breathing exercises may be given here, to finish the prescription.

Cases of obstetrical paralysis should do any exercises which develop the affected muscles and bring about strong stretching of the antagonistic muscles. Where there is no response in the muscles little can be done by exercise. Massage should be used and this may or may not be done in the school. General developing exercises for posture should be combined with any local work that may be possible.

Prescription—girl eight years old, no apparatus, entire right arm and shoulder affected, practically no power of contraction.

1. Wing standing, chest raising with deep breathing.
   Position: Standing erect, hands on hips.
   Exercise: Forcible chest elevation with deep breathing.
2. On table, trunk raising with arm extension downward.
   Position: Lying on table on face, feet strapped down, hands clasped back of waist.
   Exercise: Trunk raising with arm extension downward with arms still clasped, hold a short time and return to starting position.
3. On table on back, alternate leg raising and sinking.
   Position: On table, hands grasping top of table.
   Exercise: Alternate slow leg raising and slow leg sinking. Knees straight, toes pointed well downward.
4. On table on back, stick raising with deep breathing.

Position: On table on back, hands well separated grasping stick.

Exercise: Stick raising over head with inhalation, sinking with exhalation.

5. Rest sitting chest expansion. See Exercise No. 7, infantile group.

Tubercular spines as the tubercular hips are taken up in two stages, old and active. The active cases are usually in plaster jackets and are not exercised at all but have supervised periods of rest. The old tubercular spines are usually in a brace or without any support according to the stage of the process. These cases in braces should be given only such exercises as do not bring about motion in the effected region. Developing work as far as possible is advisable and special stress laid upon increased capacity.

For those cases that are without support care must be exerted not to overtax them. Avoid the effected region. Develop the chest, include the circulation and improve the posture where-ever the resultant deformity permits.

Prescription—dorsal tubercular spine—girl eight years old, practically cured, wears no apparatus.

1. Wing standing, chest raising with breathing. See Exercise No. 10, spastic group.
2. Standing, slow arm extension upward and sideways with light dumb-bells and deep breathing.

   Position: Correct standing position, hands bent to shoulders grasping dumb-bells.

   Exercise: Slow arm extension upward with deep breathing during the extension. Sideways in the same slow rhythm with breathing.
3. Corner. See Exercise No. 5, spastic group.
4. Reach support opposite standing, head bending backward with pressure and resistance. See Exercise No. 6, spastic group.
5. On table alternate leg raising and sinking slowly. See Exercise No. 3, obstetrical group.
6. On table on back, stick raising over head with breathing. See Exercise No. 4, obstetrical group.

7. Breathing on plinth. See Exercise No. 8, spastic group.
8. Grasp standing, alternate knee upward bending.
   Position: Standing erect, grasping stick, placed behind shoulders.
   Exercise: Slow alternate knee upward bending, knees well drawn up, held in that position a few seconds and returned to standing position.
9. Any of the variety of free standing breathing exercises may be used here to finish prescription.

Tubercular hips may be considered in two stages, old and active. The old cases in which all active process has stopped may or may not wear a convalescent splint. This will not interfere vastly with the exercises. They may do all exercises that do not involve the hip-joint. Avoiding all those things which jar or in any way bring about strain in the joint. Active tubercular hips which include hips that are draining and wearing traction splints may do only the lightest breathing exercises. They should not do any active work at all and in some cases where the vitality is low and it may seem too much tax on the child, exercise may be left out altogether and rest periods substituted.

Prescription—boy sixteen years old—old right tubercular hip, no apparatus.

1. Standing, arm raising sideways with deep breathing.
   Position: Standing in erect position.
   Exercise: Arm raising from side to shoulder level with deep breathing.
2. Hanging. See Exercise No. 4, spastic group.
3. Rest, sitting chest expansion. See Exercise No. 7, infantile group.
4. Reach sitting, arm parting with pressure.
   Position: Sitting erect on bench, arms raised in front of body to shoulder level.
   Exercise: Arm parting sideways with resistance by operator on back of arm. Breathing advisable, arms returned with no resisting pressure.
5. Corner. See Exercise No. 5, spastic group.

6. Bend standing, arm extension upward and sideways with dumb-bells. See Exercise No. 9, spastic group.
7. Reach support opposite standing, head bending backward with pressure and resistance. See Exercise No. 8, infantile group.
8. On table on back, stick raising over head with breathing. See Exercise No. 4, obstetrical group.

Prescription—boy fifteen years old—old right tubercular hip with slight left lumbar scoliosis. No apparatus worn.

1. Standing, stick raising over head with breathing.
   Position: Standing at window, grasping stick, hands well separated.
   Exercise: Stick raising over head with deep inhalation, sinking with exhalation.
2. On table on face, hands clasped backward, trunk raising with arm extension downward. See Exercise No. 7, spastic group.
3. On table on face, hands on hips, spine stretching, trunk raising and bending to the left with pressure.
   Position: On table on face, hands on hips, feet strapped down.
   Exercise: Spine stretching by pushing hands down on hips. Trunk raising and bending to left with pressure by operator on apex of lumbar deviation.
4. Rest sitting chest expansion. See Exercise No. 7, infantile group.
5. Reach support opposite standing, head bending backward with pressure and resistance. See Exercise No. 6, spastic group.
6. Hanging. See Exercise No. 4, spastic group.
7. Shelter self correction.
   Position: Standing in erect position hands clasped on top of head, feet firmly on the floor.
   Exercise: Spine extension upward against pressure on top of head. Symmetry of trunk should be attained if possible.
8. Sitting raising 5-pound dumb-bell over head on right.

Position: Sitting, right hand grasping 5-pound dumb-bell, left hand pressing on rotation.

Exercise: Stretching 5-pound dumb-bell over head. Holding stretch position as long as possible.

9. Corner. See Exercise No. 5, spastic group.
10. Standing arm extension upward and sideways with dumb-bell. See Exercise No. 9, spastic group.
11. Any of the numerous free standing breathing exercises may be given here, to finish the prescription.

Prescription—right T. B. hip—girl fourteen—wears apparatus.

1. Sitting at window, arm parting with dumb-bells, deep breathing.

   Position: Sitting on bench at window grasping dumb-bell. Erect position held if possible.

   Exercise: Arm parting with breathing.
2. Rest sitting chest expansion. See Exercise No. 7, infantile group.
3. Reach support opposite standing, head bending backward with pressure and resistance. See Exercise No. 6, spastic group.
4. Corner. See Exercise No. 5, spastic group.
5. On table, stick raising over head with breathing. See Exercise No. 4, obstetrical group.
6. End prescription with any of the free standing breathing exercises.

Congenital hips are either single or double. The child may do any exercise that is possible without causing too much strain on the joint. By exercises the muscles may be strengthened and the attitude and gait improved after the reduction. Reduction of the deformity is not possible by exercises and should not be attempted, the forcible manipulations naturally being left to a surgeon.

Prescription—double congenital hip—girl thirteen years—no apparatus.

1. At window, armr aising sideways with dumb-bells and deep breathing. See Exercise No. 1, infantile group.
2. Corner. See Exercise No. 5, spastic group.

3. Rest sitting chest expansion. See Exercise No. 7, infantile group.
4. Standing, arm extension upward and sideways with dumb-bells vigorous. See Exercise No. 9, spastic group.
5. Reach support opposite standing, head bending backward with pressure and resistance. See Exercise No. 6, spastic group.
6. Hanging. See Exercise No. 4, spastic group.
7. Rest, grasp support sitting, trunk bending backward.
   Position: Sitting on bench chest high, feet held down, hands behind head.
   Exercise: Trunk bending slowly backward short distance, and returning to starting position.
8. Grasp prone lying over end of plinth. Double leg raising backward.
   Position: Lying on face over end of plinth just trunk supported, hips flexed, hands grasping sides of plinth.
   Exercise: Extend hip-joint by raising legs backward.
9. Walking.
   Position: Standing in erect position, hands on hips.
   Exercise: Slow march forward getting as much motion in hip-joint as possible.
10. Massage.

Tubercular joints including knees and ankles may do any exercises which do not involve the effected joints. These cases usually wear plaster splints to mobilize the joint so that the apparatus rather assists the gymnastic work in preventing any motion occurring in the joint while the child is exercising.

Prescription—T. B. knee-joint (tumor albus). Girl twelve years on crutches.

1. Sitting, arm raising sideways with dumb-bells and deep breathing. See Exercise No. 1, infantile group.
2. On table, hands on hips, spine stretching with trunk raising.
   Position: On table, face down, hands on hips.
   Exercise: Spine stretching upward, hands pushing down on hips, trunk raising.

On table, trunk raising, arm extension sideways, with dumb-bells. See Exercise No. 6, infantile group.

3. Hanging. See Exercise No. 4, spastic group.
4. Shelter self correction. See Exercise No. 7, tubercular hip group.
5. Reach support opposite standing, head bending backward with pressure. See Exercise No. 6, spastic group.
6. Corner. See Exercise No. 5, spastic group.
7. Standing arm extension upward and sideways with dumb-bells. See Exercise No. 9, spastic group.
8. Rest sitting chest expansion. See Exercise No. 7, infantile group.
9. Any of the numerous free standing breathing exercises to finish the prescription.

In dealing with congenital abnormalities such as club feet or hands, webb fingers, any exercises may be indulged in that are possible for the child to do provided no organic condition exists which would interfere. In the club-foot cases stretchings are valuable.

The deformities resulting from rickets are many. Among those with which we come in contact, are knock-knees, bow-legs and scoliosis. For these conditions, forcible stretchings and bendings, and exercises for muscle training are valuable and effective. Usually in extreme cases of knock-knees or bow legs, braces or plaster casts are worn. If possible these should be removed and forcible manipulations used. Scoliosis will be referred to later.

Prescription—girl nine years old—knock-knees, right dorsal left lumbar scoliosis, wears jacket and splints for correction of knees.

1. Sitting, arm raising sideways with dumb-bells and deep breathing. See Exercise No. 1, infantile group.
2. Hanging (left hand high). See Exercise No. 4, spastic group.
3. Rest sitting chest expansion. See Exercise No. 7, infantile group.
4. Sitting, forcible leg extension with outward pressure on knees.

Position: Sitting in erect position on the bench, or lying on plinth on back with knees bent.

Exercise: Extension of knee-joint with forcible pressure outward on inside of knee-joint.

5. Wing standing, heel raising, deep knee bending.

Position: Standing with hands on hips, feet parallel.

Exercise: Rising on toes, deep knee bending, knees turned well out.

6. On table face down, hands on hips, spine stretching, trunk bending right with pressure.

Position: On table face down, feet strapped down, hands on hips.

Exercise: Spine stretching, hands pushing down on hips, trunk bending to right, strong pressure by operator on rotation in the dorsal region.

7. On table, spine stretching, trunk raising and bending to left with pressure.

Position: On table on face, hands on hips, spine in stretched and raised position.

Exercise: Trunk bending left, pressure on rotation in lumbar region.

8. Bend standing, arm extension to key-note position with dumb-bells.

Position: Hands at shoulders grasping dumb-bells.

Exercise: Stretch left arm upward, right arm backward, slow continued stretching is better here than a quick vigorous effort.

9. Corner. See Exercise No. 5, spastic group.

10. Breathing exercise.

Prescription—boy six years—bow legs—good physical condition otherwise.

1. Standing, stick raising with breathing. See Exercise No. 1, spastic group.
2. Hanging. See Exercise No. 4, spastic group.
3. Rest sitting chest expansion. See Exercise No. 7, infantile group.
4. Reach sitting, arm parting with pressure. See Exercise No. 4, old right T. B. group.

5. Standing, arm extension with dumb-bells. See Exercise No. 9, spastic group.
6. Corner. See Exercise No. 5, spastic group.
7. Reach support opposite standing, head bending backward with pressure and resistance. See Exercise No. 6, spastic group.
8. Sitting, forcible leg extension with inward pressure on apex of bowing.
   Position: Sitting or lying on plinth, knees drawn up.
   Exercise: Extend knee-joint, operator gives pressure on outside of leg at apex of bowing.
9. Walking with knee bending and stretching.
   Position: Hands on hips, erect position.
   Exercise: Slow march forward with knee bending and extending. Watch posture throughout.
10. Breathing exercise.

Kypho scoliosis or the more severe and consequently deforming type of scoliosis is to be dealt with here only from one side, that of benefiting the general condition of the child with no idea of entirely reducing the deformity. Following along these lines we would give any exercises that develop the chest. These cases usually wear jackets either leather or plaster. If possible these supports should be removed during the period of activity and replaced again as soon as the exercises are finished. The removing of the support allows the child freer motion and flexibility work may be given. If this is done, careful watch should be kept over the jacket, and it should be padded accordingly, in order that it may not lose its efficiency. By increased flexibility these cases are often able to "get away" from the push of the jacket. Therefore, constant pressure should be given by increasing the felt padding which may be placed so as to fill in the space. A wide range of exercises is possible in these cases and a good deal accomplished under perseverance.

Prescription—boy fifteen years old—right dorsal left lumbar kypho scoliosis, wears leather jacket which is removed while exercising.

1. Standing, arm raising with heel raising and deep breathing.

Position: Hands at sides, standing in erect position.

Exercise: Arm raising sideways to shoulder level with heel raising and deep breathing.

2. Hanging (left high) See Exercise No. 4, spastic group.
3. Breathing with pressure.

Position: Standing pelvis supported.

Exercise: Deep breathing with pressure by operator on anterior rib deformity.

4. At pulley arm extension over head with 10-pound weight.

Position: At pulley in charge position, left hand grasps pulley rope, right hand on dorsal rotation.

Exercise: Arm extension over head with charge (left foot). Pressure made on dorsal rotation at the same time as the left arm is extended.

5. Corner. See Exercise No. 5, spastic group.
6. Sitting, left arm extension with 5-pound dumb-bell.

Position: Sitting on bench, right hand on dorsal rotation, left hand grasping 5-pound dumb-bell.

Exercise: Slow arm extension, left with 5-pound dumb-bell. Pressure made on dorsal rotation with right hand.

7. Postural stretch with 5-pound dumb-bell.

Position: Body in horizontal position against wall, left hand high and back over head with 5-pound dumb-bell. Right hand on dorsal rotation. Left leg stretched sideways as far as possible making the left hand and the left foot as far apart as possible. This position is maintained with stretching increased to the limit.

8. Rest sitting chest expansion. See Exercise No. 7, infantile group.
9. On table lying on back, leg raising and sinking slowly. See Exercise No. 3, obstetrical group.
10. On table on face, trunk bending to right with dorsal pressure.

Position: Lying on face on table, hands on hips, feet strapped down.

Exercise: Trunk bending to right with hand on dorsal rotation.

11. On table on face, trunk raising and bending left with pressure.

Position: On face on table, hands on hips, feet held down.

Exercise: Trunk raising and bending to the left with pressure on lumbar rotation.

12. Breathing.

Traumatic amputations need no particular comment. The children are usually healthy and aside from the inconvenience of being minus a hand or a leg the child is not handicapped and may do any exercise possible to perform.

The ankylosis accompanying arthritic joints makes exercises almost impossible without assistance. Massage and passive motions are advisable and general developing work for chest capacity should be given as freely as possible.

Prescription—boy twelve years—traumatic amputation of right leg below knee, wears splint.

1. Standing, arm raising sideways with deep breathing and dumb-bells. See Exercise No. 1, infantile group.
2. Hanging. See Exercise No. 4, spastic group.
3. On table, trunk raising with arm extension downward. See Exercise No. 2, obstetrical group. On table, trunk raising with arm extension over head with stick.

   Position: On table on face, stick raising over head, feet held down.
4. On table on back, double leg raising and sinking. See Exercise No. 3, obstetrical group.
5. Corner. See Exercise No. 5, spastic group.
6. Standing, arm extension upward and sideways with dumb-bells vigorous. See Exercise No. 9, spastic group.
7. Rest sitting chest expansion. See Exercise No. 7, infantile group.
8. Breathing.

A great variety of apparatus is not necessary in dealing with these children, a plinth, a table, a trapeze, a number of benches, an adjustable pulley weight, a number of pairs of dumb-bells varying in weight from one to five pounds and a dozen wands will be ample.

After close supervision of over a hundred children for three years under the gymnastic conditions given in this paper we are convinced by the results gained that the field of gymnastic work should be opened to these children as well as to the normal individual. Closer supervision is of course necessary, care in adjusting the prescriptions, exactness in the detail of giving the exercises are all to be emphasized. Following the actual measurements of these children who have been for three years under treatment of this kind we find increased height and weight. Improvement in carriage is marked in many cases. There has been less sickness, no outbreaks of contagious diseases and altogether a more healthy set of children than under conditions which allow of no activity and prohibit systematized exercise.

CLINICAL DEPARTMENT.

XI.

HUMAN CARRIERS IN POLIOMYELITIS.*

R. B. OSGOOD, M. D.

Since our note on the finding of the virus of anterior poliomyelitis in the tonsils of recovered monkeys (*Journal of the American Medical Association*, February 18, 1911, Vol. LVI, pp. 495–497), we have been carrying on similar experimentations with human tonsilar and nasopharyngeal tissue as we were able to obtain them from time to time. Our results in this we presented to the Boston Society of Medical Sciences, in the spring of 1912. Our conclusions were that the results of these experimental studies with the filtrates of human nasopharyngeal tissues removed at varying periods after the acute attack, may be said to be suggestive but not conclusive for the following reasons:

In three monkeys injected with three different tonsilar extracts, no clinical signs of poliomyelitis followed the inoculations.

In two monkeys, the clinical signs were typical, but we were unable to pass the infection on to a second series of monkeys in a perfectly conclusive manner, nor were the pathological findings absolutely typical though suggestive, although they were much the same findings as those described by Klung, Petterson and Werngstedt (Investigations on Infantile Paralysis, Report from the State Medical Institute of Sweden to the Fifteenth International Congress on Hygiene and Demography, Washington, 1912), in their investigations as to the duration of the virus in the human body.

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* Published in the Journal of the American Medical Association.

We felt convinced that the nasopharyngeal tissue of recovered human cases was able to hold the virus for at least six months; but owing to the far-reaching importance of such a fact, we withheld the data from print. Since then, however, these facts have been proved conclusively by Klung, Petterson, and Werngstedt, and by Flexner. Further, these investigations have proved the presence of the virus in the washings from the nasopharynx not only of patients in the acute stage of the disease, but what is still more significant, the virus has been found in washings from the nasopharynx of parents, attendants, and friends; and, further, Klung, Petterson and Werngstedt have found the virus present in nasopharyngeal swabbings and washings as late as 204 days (seven months) after the infection.

The case we wish to report falls into this latter class of carriers, but the probable duration of the carier was two years and three months.

R. H. (Patient of H. G. Rockwell, Amherst, Mass.) had his attack of paralysis in February, 1910. He was first seen by one of us (R. B. O.) on February 19, 1912. At that time he showed a residual paralysis of the dorsal flexors of both feet and in the peroneal group of the right. He improved till September, 1912, when, after an attack of apparent bronchitis and coryza, the child became suddenly weak in the right arm, with increased weakness of the affected legs as well. This was associated with fever and the mother considered it to be a second attack of paralysis. The boy gradually recovered. Within two weeks after this apparent exacerbation, his young sister, aged ten, had high fever, and one of her arms became completely paralyzed, with weakness of the legs. When the boy was seen on November 8, 1912, six weeks after his recovery from the second attack, he was almost back in muscular strength to where he had been before, without any remaining paralysis of his arm. He still had a certain amount of nasal secretion. Through the efforts of his parents, we were able to obtain 10 c.c. of clear mucoid nasal secretion on November 11. With this material passed through a Berkefeld filter, we inoculated two monkeys on November 15, with negative results. Again on January 3, 1913, we received some nasal secretion and inoculated two monkeys with negative results.

We repeated this again, on January 22, injecting 10 c.c. of the filtrate intracerebrally into monkey No. 157. This monkey became paralyzed on February 2 and died on February 5. He developed complete paralysis of all four extremities. The pathological picture of his cord (Dr. H. C. Low) was not typical but very suggestive.

On January 31, we again repeated the injection of filtrate from a fresh specimen of nasal secretion, inoculating two monkeys, Nos. 159 and 160. No. 159. received 5 c.c. of the filtrate intracerebrally and 10 c.c. intraperitoneally. He became paralyzed on February 5 and died, completely paralyzed, on February 8.

Cord and medulla pathologically (Dr. H. C. Low) were typical of anterior poliomyelitis; and on April 9 we injected two monkeys, one with the cord emulsion of monkey No. 157, and the second with the cord of monkey No. 159. This last monkey, No. 161, received 8 c.c. of a cord emulsion from monkey No. 159. He became paralyzed on April 26 and died on April 27, with typical complete paralysis. The pathological findings (Dr. H. C. Low) were typical of anterior poliomyelitis. This case seems to us of special interest—first, as demonstrating the long period during which the virus was undoubtedly harbored in the nasopharynx; second, a human infection (his sister) occurring two years after his primary attack during what seemed like an exacerbation of his former attack; and, third, the recovery of the virus from his nasal secretions four months after his second attack and two years and three months after his first attack; fourth, the successful inoculations were done with filtrates from straight nasal secretions, not from washings.

Pathological Report.

Dr. H. C. Low.

No. 159.—Sections of the cord in the lumbar and cervical regions show moderate injection of the blood-vessels and some small round-cell infiltration about them. Changes are not marked out consistent with the diagnosis of poliomyelitis.

No. 161.—Sections of the lumbar, dorsal and cervical regions show marked small round-cell infiltration about the blood-vessels and in the perivascular lymph spaces more evident near the central canal and anterior horn. The changes are typical of poliomyelitis.

XII.

SPONTANEOUS FRACTURE IN CARCINOMA OF THE BONES.

BY GEORGE W. HAWLEY, M. D., BRIDGEPORT, CONN.

During the past three years three cases of spontaneous fracture in skeletal carcinoma have come under my observation.

The first patient, a woman of fifty-five years began in July, 1907, to experience a feeling of general weakness accompanied by pain in the back, legs and right breast. This weakness increased so that in December she had become bedridden. The following February a mammary growth was detected and the breast excised, but the weakness and lumbar pain persisted. Four months after operation she attempted to walk, but was forced to return to bed. One year after operation, while standing in a bath tub, the left femur gave way with an audible crack. Three months later the right femur was broken while being lifted from a bed pan.

I first saw this patient nearly two years after the breast operation. She then presented an unusual appearance. The left leg lay in extension and rotated outward 90 degrees while the right was flexed, rotated inward, and adducted. There were only a few degrees of motion in either hip. In the region of the left trochanter was felt a large irregular mass of bone, while the shaft of the right femur gave the impression of being symmetrically enlarged above.

The radiographs taken showed fracture of the left femur in the upper third with angulation and considerable callus, a subtrochanteric fracture of the right femur with union of the fragments in marked angular deformity, and irregular honeycombing throughout both femora.

Autopsy was performed by Dr. P. W. Nathan and myself in February, 1910, with a rather complete dissection of the entire skeleton. A general carcinomatosis of the bones was found, although their external appearance gave no indication of disease. The cancer tissue was scattered in small, irregular masses throughout every bone examined. The bones of the

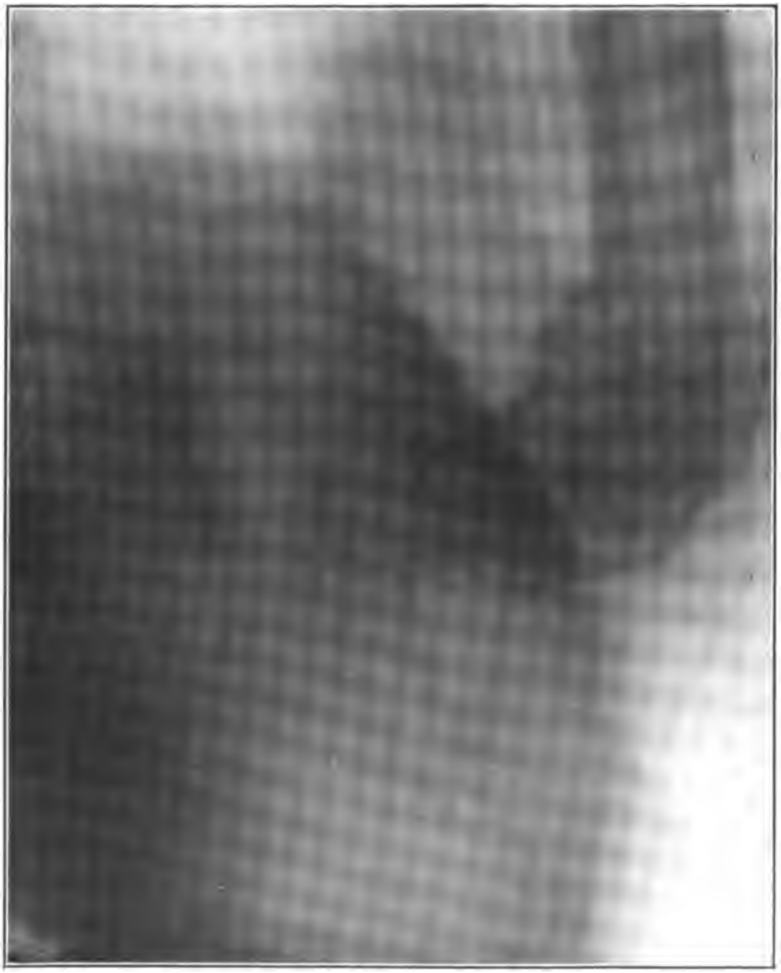


FIG. 1.—Case I. Radiograph of left hip showing old subtrochantic fracture with overriding of fragments. Union with adduction deformity. Areas of carcinoma deposit throughout callus and shaft.

skull, hands, and feet were the only ones not inspected. In many places little cortical framework remained. The ribs broke in many places with moderate handling.

The second case was a woman of forty-five, who was treated for rheumatism in the winter of 1908, with pain chiefly in the left hip. In May, she discovered a lump in the left breast, which was removed for carcinoma four months later. Following the operation she continued to have pain in the back and limbs accompanied by a feeling of increasing weakness. About two years after her operation she fractured the right radius and left femur while in the act of lifting herself into a street car.

This case was referred to me in January, 1911, with the diagnosis of spinal disease. She was then complaining of severe pain in the spine, prostration, and stiffness of the legs. She evidenced great fear and apprehension in attempting slight muscular exertion. She was very obese. Examination revealed union of the radius with some angulation and union of the femur in outward rotation with 1 1/2 inches shortening. The forearm was fixed in pronation, and there was a spindle-shaped enlargement of the femur in its middle third. She was tender over the sternum, several ribs, and lumbar vertebræ. There was no evidence of recurrence at the site of operation.

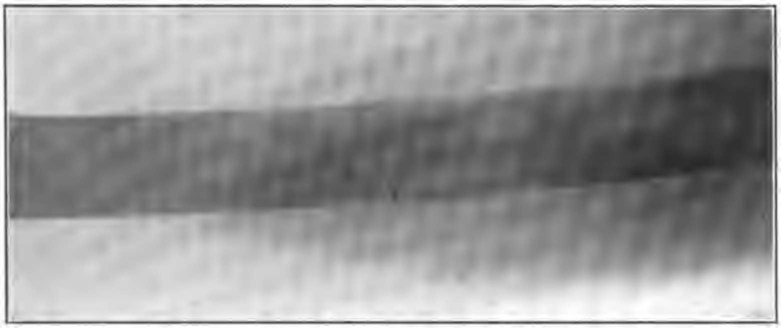


FIG. 2.—Case I. Radiograph of left femur showing areas of carcinoma invasion.

Radiographic examination showed an old fracture of the radius with axial displacement, and extensive cortical atrophy throughout the upper half of the shaft. Discrete, isolated areas of absorption were also found in the right ulna and humerus, and both femora.

On December 10, 1911, the right clavicle was fractured during the effort of adjusting a pillow beneath the head. Because of her bed-ridden and weakened condition, no effort was made to reduce or fix the fragments, which nevertheless, rapidly united, but with considerable deformity. In November, 1912, the left humerus was broken in its lower third, as she was pulling an invalid stand to the bedside. After fixation for five weeks, it was found that the humerus had united in apparently good position. This patient is still alive, nearly three years after her first fracture. Her emaciation and cachexia are extreme, and there have been evidences, for some months of pulmonary, hepatic and peritoneal metastases.

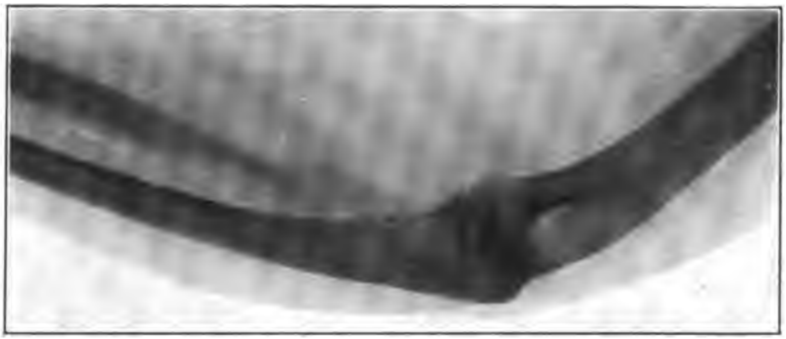


FIG. 3.—Case II. Radiograph of right forearm showing carcinoma erosion of radius.

The third case, Miss R., fifty-four years of age, became aware of a nodule in her right breast four years ago. For the past three years she has had intermittent pain in the back, shoulders, and legs. She has never had any pain in the breast, and has never sought medical advice. Her general health has been excellent.

On September 15, 1911, while pulling the bed-clothes over her shoulders, she felt her left arm snap and fall helpless at her side. Examination the following day demonstrated a fracture of the humerus in the middle third. The right breast was almost wholly replaced by a hard, cicatricial growth tightly adherent to the chest wall. The five upper ribs of the same side were found to be enlarged and nodular. There was tenderness over the sternum and the ribs of both sides. X-ray examination was refused.

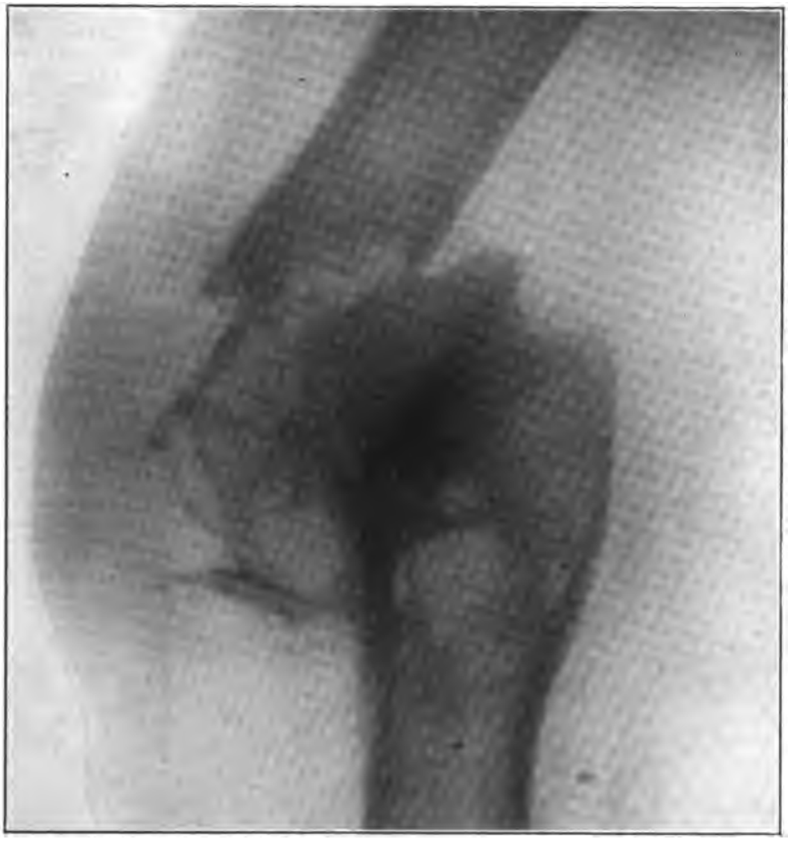


FIG. 4.—Radiograph loaned by Dr. L. G. Cole, of New York. Case of metastases from mammary carcinoma with spontaneous fracture of femur. Fracture had occurred at same site two years previously. Union resulted after each inquiry.

The arm was immobilized in a plaster-of-Paris dressing, which was removed after the fourth week when excellent union was found to have taken place. About the middle of October she began to fail rapidly and died December 20, 1911. Autopsy could not be obtained.

Carcinoma of the bones is a disease which presents many peculiar and interesting features, of which American literature treats briefly, and often incorrectly. It is frequently described and confused with sarcoma.

von Recklinghausen, 1891, was the first to make a careful investigation of this neoplastic disease of the bones. His work was undertaken accidentally, as a result of his discovery of the frequency of skeletal metastasis in cancer of the prostate. He studied in all five cases. Ten years later Kaufmann published his findings in sixteen cases from the Basel Pathological Institute, together with eighteen cases taken from the literature.

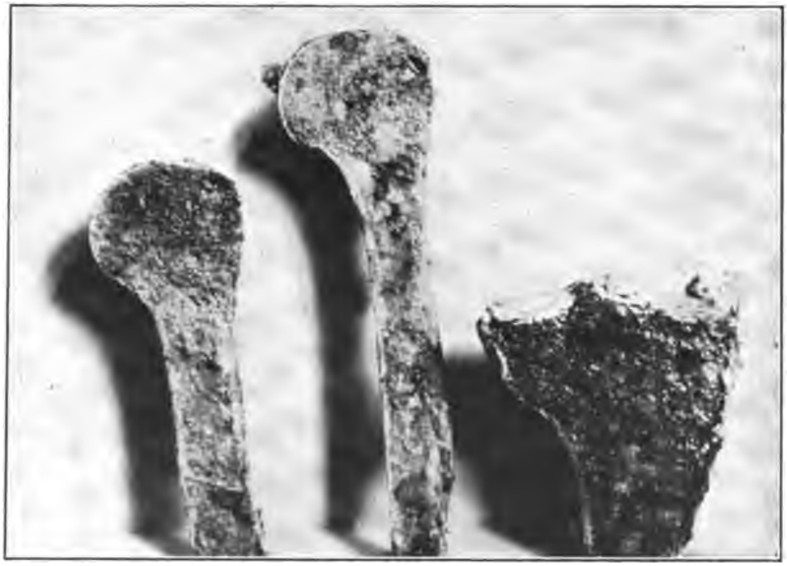


FIG. 5.—Case I. Photograph made at autopsy. Sections of right and left humerus, and left tibia.

According to Kaufmann, carcinoma of the bones is never primary. Bone, being of mesoblastic origin is unsuitable embryologic soil for the initial development of carcinoma.

It is always secondary to a growth in some epithelial structure, and in the majority of instances, secondary to disease in the breast, prostate, or thyroid, which fact led Neusser to suggest a "Blutverwandschaft" between these organs and the bone marrow. Kaufmann found bone metastasis in 72 per cent. of terminal prostatic carcinoma. Lenzinger places its occurrence in 37 per cent. of thyroid and Limacher in 14 per cent. of mammary cancer.

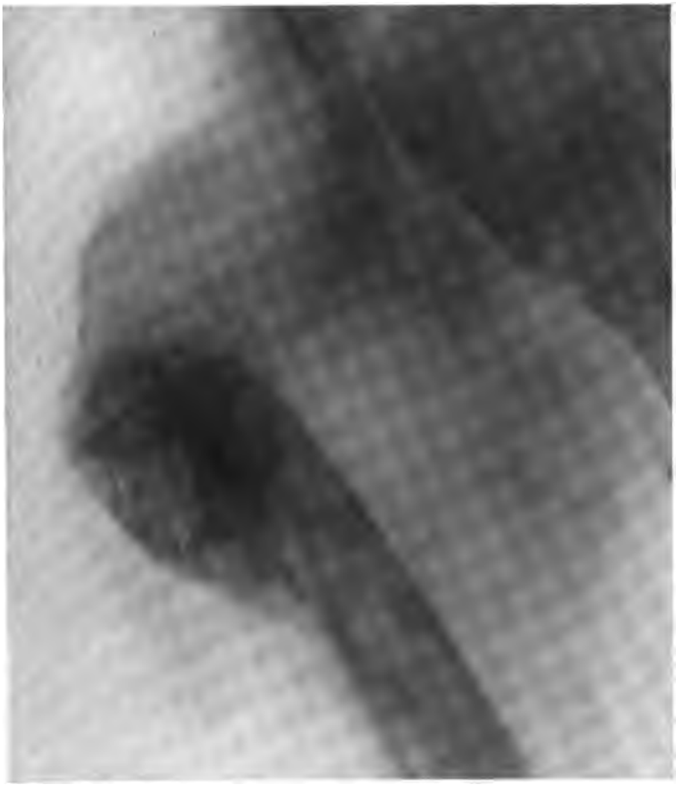


FIG. 6.—Case I. Radiograph of right hip showing old fracture of femur in marked deformity.

von Recklinghausen early pointed out the fact that almost invariably a number of bones are involved, and that certain bones appear to be favorite sites for deposit, namely, the vertebræ, femur, ribs, ilium and the skull. Kaufmann in his thirty-four cases found the vertebræ involved in twenty-seven, the femur in twenty-three, the ilium in twenty-one, the ribs in nineteen and the skull in eleven.

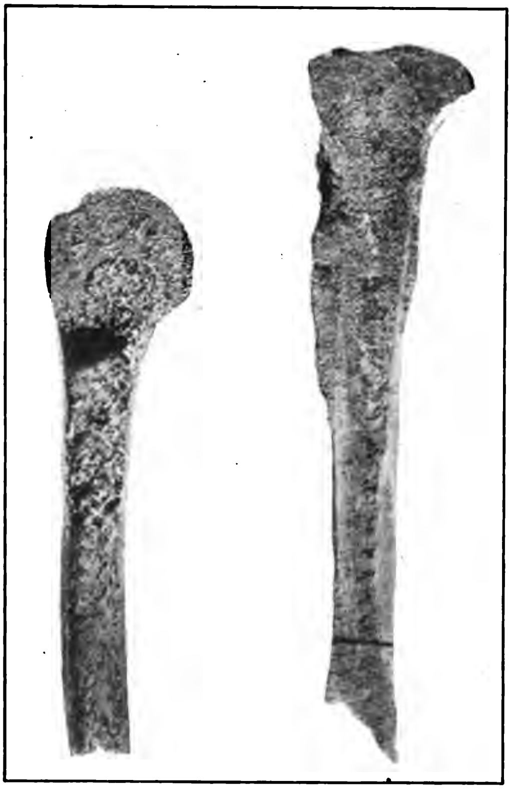
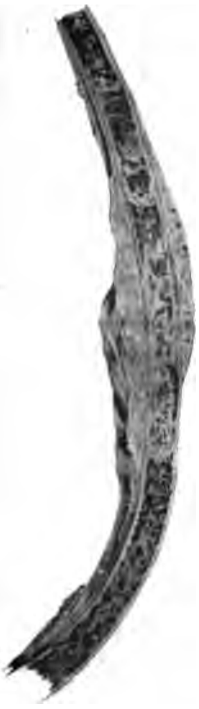


FIG. 7.—Osteoplastic "carcinose" of the head and upper end of the right humerus, showing miliary osteoporosis in the head and neck, and small growths of new bone in the central canal. (*After Kaufmann, Case III.—Basel Collection.*)
FIG. 8.—Osteoplastic "carcinose" in the right tibia—in part osteoplastic and part osteoclastic. (*After Kaufmann. Case III.—Basel Collection.*)

This disease has been described as an "osteomalacia carcinomatosa" in which nests of cancer tissue are found scattered throughout the marrow and spongy parts of the bones. This invasion produces a pressure absorption with disappearance of cortical structure. At the same time new bone formation occurs. The two processes, destruction and repair, go hand in hand. Extension to the periosteum is followed by subperiosteal deposit of new bone. Penetration through the periosteum into the soft parts or into a joint cavity has not been recorded.



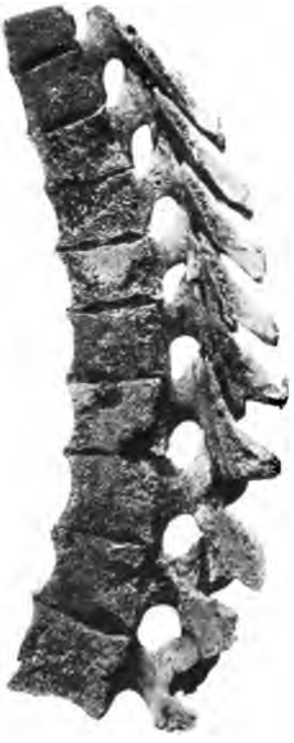


FIG. 9.—Longitudinal section through a carcinomatous rib. (*After Kaufmann. Case IX.—Basel Collection.*) In this case metastases also in the pelvis, vertebræ, right femur, and right humerus.

FIG. 10.—Part osteoclastic, part osteoplastic "carcinose" of the vertebræ—fifth dorsal to second lumbar. (*After Kaufmann. Case VIII.—Basal Collection.*)

It is natural that a malignant disease which causes so little gross change in the architecture of bone should escape clinical detection. Out of Kaufmann's thirty-four cases only a very few were suspected during life, and in only three were there bone tumors of sufficient size to be felt. The cases usually recognized are those with spinal symptoms, those with obvious bone enlargement, or those complicated with fracture. Among the cases reported, many are instructive. In a few amputation has been done for bone tumor, where subsequent autopsy showed a more or less general invasion of the skeleton. In some, radiographic examination has given the first clue to the diagnosis. In others, evidence of bone cancer has preceded the finding of the primary tumor. In a case reported by Grunert, a tumor of the skull and spontaneous fracture of the humerus and femur preceded the finding of a cancer of the thyroid. In many cases the disease of the bones has not made its appearance until six or eight years after apparent operative cures in breast cancer. A case has recently come to my notice of a man who was treated in several institutions for severe lumbar pain. Only at the last was it discovered that he had a small, non-obstructive carcinoma of the prostate with advanced involvement of the bones. This case emphasizes Kaufmann's statement, made after a study of 100 cases of cancer of the prostate, "That the finding of metastases in the bones is frequently the first evidence of a prostatic tumor."

Fracture in carcinoma of the bones has received little attention. Grunert in his elaborate study of pathological fractures places sarcoma first, and carcinoma second, among the diseases leading to spontaneous fracture. He cites four cases. Blumer reports two interesting cases of multiple fracture, and multiplicity appears to be the rule rather than the exception.

Fracture is described as an uncommon complication of carcinoma. Kaufmann mentions it in only four of his thirty-four cases. In ten cases which I have seen fracture occurred in three.

The statement in one of the recent volumes on fractures that, "Union almost never takes place after fractures associated with metastastic carcinoma" would seem to need qualification. In all cases where I have found mention of the fact, union has been prompt and complete. In one case the same femur was fractured at two different times with consolidation after each injury. Union resulted in all of the seven fractures reported above.

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XIII.

TENDON FIXATION—AN OPERATION FOR THE PREVENTION OF DEFORMITY IN INFANTILE PARALYSIS.

BY W. E. GALLIE, M. B.,
Associate Surgeon, Hospital for Sick Children and Junior Surgeon, General Hospital, Toronto, Ont.

A preliminary report of this operation has already appeared in the *Annals of Surgery*, March, 1913.*

The author has now had considerably more experience with the method and feels at liberty to make a further report upon the technic and upon the results obtained. The first operation was performed nearly a year ago so that the cases as they stand at present must give a fair indication of the final results to be expected.

The operation aims at preventing deformity of the feet by fastening the tendons of the completely paralyzed muscles to the tibia and fibula in such a position that they imitate in the closest manner possible, the functions of the tendons under normal conditions.

The method was first tried on a case of paralytic varus in which there was permanent complete paralysis of the peronei with practically complete recovery of the other muscles. Forcible correction, arthrodesis at the midtarsal joint and braces failed to prevent recurrence of the varus deformity. An incision about three inches long was made on the outer side of the leg, as shown in the accompanying photograph, over the external malleolus. The peronei tendons were exposed and lifted from their sheath. A two and a half inch incision was then made

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*When this report was made the author was under the impression that the method was wholly original with him but a more careful review of the literature has disclosed the fact that a somewhat similar principle was employed by Sangiorgi, Bologna, Italy and reported by him in *Rcvista de ortopedia*, Naples, 1901.

through the periosteum, along the anterior border of the external malleolus—and the periosteum stripped back for a quarter of an inch on either side of the incision. With a gouge a piece of bone was removed from the external malleolus, the full length of the periosteal incision, of the thickness of the peroneus brevis. This tendon having been drawn taut with a pair of clamps, was laid in the trough thus prepared for it and the periosteum sewn over it with No. 1 chromicized cat-gut. The suture was passed through the tendon several times, to hold it firmly in position. The photograph shows the peroneus brevis tendon buried in the bone. A similar trough was next prepared for the peroneus longus tendon, on the posterior edge of the external malleolus. The photograph show sthis trough

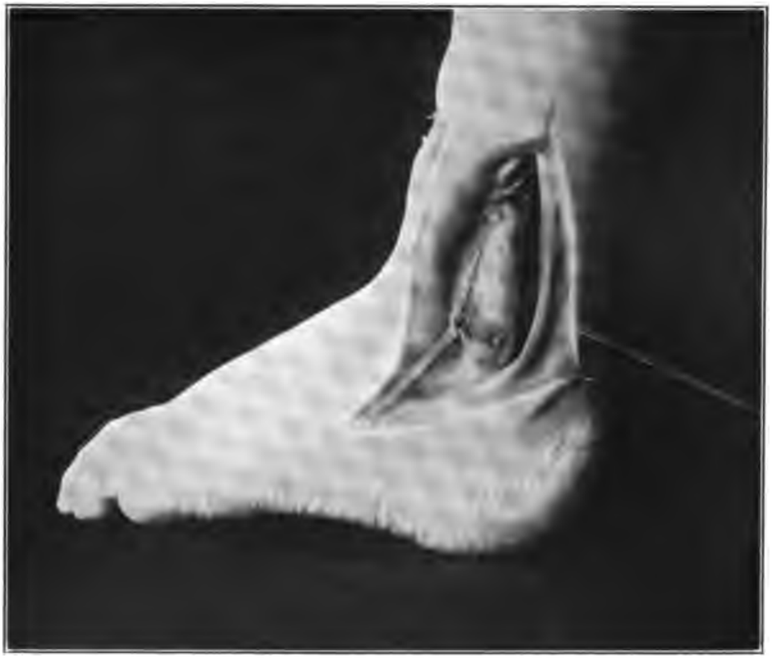

FIG. 1.—Photograph illustrating "Tendon fixation," of peroneus brevis and longus tendons. In the case of the peroneus brevis the operation has been completed. In the case of the peroneus longus the trough is shown prepared for the tendon which is held aside by a ligature.

ready for the reception of the tendon. The tendon was drawn taut and sewn into position as already described. By burying one tendon in the anterior border and the other in the posterior border of the malleolus, any tendency to equinus or calcaneus was prevented. The skin incision being closed, the foot was put up in plaster of Paris and the patient was kept from walking for two months. At the end of that time the plaster was removed and the patient allowed to walk without support of any kind. This he has continued to do up to the present, that is for nearly a year. There has been no recurrence of the varus, the fixed tendons being firmly united to the fibula, preventing completely adduction or inversion of the foot. He walks practically without a limp.

This particular operation for paralytic varus has now been performed on ten occasions and up to date the results are as satisfactory as in the case described. The ages of the patients vary from two and a half to thirty years.

The method has also been applied to paralytic calcaneus. In these cases a five-inch vertical incision is made along the outer border of the tendo Achillis, down to the attachment of this tendon to the os calcis. The tendo Achillis is isolated and the incision deepened to expose the muscular belly of the flexor longus hallucis, which is drawn aside to expose the posterior surface of the tibia. A trough, two and a half inches long and the width of the tendon is made in the middle of the posterior surface of the tibia and in order that it may be deep enough to allow the tendon to be buried, it must expose the medullary cavity. The tendon is drawn taut, the foot being held in slight equinus and the operation completed as in the case of the peroneals. In those cases in which the peroneal muscles are active, the peroneal tendons are divided at the outer border of the foot and are transplanted into the os calcis (Nicoladoni).

Up to the present time this operation has given remarkably good results. The tendon becomes firmly adherent to the bone and most effectively prevents calcaneus. The patients are able to take the weight on the ball of the foot, raising the heel from the ground, thus greatly improving the gait. In those cases in which the peronei were transplanted, an interesting observation has been made. The author had hitherto never seen a Nicoladoni's operation result in any great improvement to the patient. The usual result has been that following the transplantation, the peronei muscles which had been strong up to the time of the operation, apparently lost their power and the calcaneus deformity and the absence of voluntary plantar flexion of the foot remained unchanged. When this operation is associated with tendon fixation, however, the power of plantar flexion of the foot developed by the transplanted peroneal muscles, is remarkable. One patient for instance is able to rise up on his toes, lifting half of his weight with the transplanted muscles. It is possible that Nicholadoni's operation fails so often because the peroneal muscles are not strong enough to prevent their being stretched and they are thus immediately rendered useless. When the transplantation is associated with fixation of the tendo Achillis, stretching of the transplanted peronei is impossible and the muscles, therefore, strengthen with use.

This operation has been performed only on cases of complete paralysis of the calf muscles, in which the degree of valgus which so frequently accompanies calcaneus has not been extreme. It is not likely that it can replace astragalectomy (Whitman) in these severe cases, but for the cases of moderate severity, if the results so far obtained prove permanent, it has the advantage of preserving a much more normal foot than that obtained after astragalectomy.

The method has also been employed in cases of drop foot and of valgus. In the former the tibialis anticus tendon was fixed to the anterior surface of the lower end of the tibia and the result was fair. In the latter the tibialis posticus was fixed to the posterior border of the internal Malleolus, but the result was not satisfactory. It has also been done in conjunction with arthrodesis and astragalectomy, giving favorable results. Recently it was tried in some cases of dangle foot, several tendons being fixed, but it is too early yet to report the results of these operations.

The permanency of the results following these operations is of course problematical. Undoubtedly the tendons become firmly fixed in the bone but it is uncertain that the tendon will not stretch or that it will maintain the same rate of growth as the foot. From the results obtained so far, however, the author feels justified in continuing the operation for cases of recurring varus and for cases of calcaneus or moderately severe calcaneo-valgua.

EDITORIAL.

The subject of scoliosis is perhaps the one most prominently before orthopedic surgeons at this time. From Dr. Lovett's paper in this number of the Journal one may readily see through what changes of opinion this subject has passed since the days that Hippocrates and other early medical authorities began to call attention to the condition and attempt to explain its phenomena. To say that we of this generation are not in a position to be very dogmatic as to the etiology of the deformity is putting the matter very mildly. There has been nothing added to our knowledge in this respect since Böhm called attention to the frequency with which vertebral anomalies are associated with the deformity. Whether these are in many cases causally related to the development of the scoliosis may be doubted. Not enough consideration is given to those associated phenomena occurring at the time of the development of scoliotic distortions. The majority of patients who develop the deformity do so at puberty or thereabouts. This is a period of life when numerous outside influences tend to affect the skeleton favorably for the production of deformity. May there not also be some pathological change in the bones incident to the physiological alterations taking place at this period which constitutes the essential cause of scoliosis? Great rapidity of growth, poor general condition, lassitude, and other phenomena appear at this time, the significance of which we do not know. There is greater physiological disturbance at this period among girls than among boys, and the former are the ones most subject to scoliotic deformities. The type of bone softening which is known as adolescent rickets occurs with greater frequency about puberty, causing most commonly a coxa vara. It is not beyond the realm of possibility that some such process may affect the vertebræ at this time, disturbing static conditions to such an extent that faulty mechanical relations and the operation of Wolff's law may effect the serious deformities which characterize high-grade scoliosis.

Our study should be directed more to the investigation of the child's metabolism at the advent of puberty and such questions as are suggested by the perversion of those physiological transformations which we know are going on in the pubescent. It does not seem reasonable to suppose that of all deformities we know scoliosis should be the only one without etiology. Neither does it seem a reasonable supposition that its cause will be found in any considerable number of instances in pure static defects.

It would seem that instead of spending so much time in trying to understand the mechanics of the deformity, on the assumption that it is upon such knowledge that scoliosis is to be overcome, we should devote more attention to a study of the physiology of the child at this crucial period of its life.

Certainly a judicial review of the results of treatment carried out in accordance with the varying theories of the cause of scoliosis does not lead one to any great optimism with regard to the results of even the latest attempts at the soultion of the problem, if by successful treatment is meant the overcoming of the two essential features of this deformity, viz., rotation and lateral deviation.

That very considerable betterment of a scoliotic deformity may be expected under treatment is certainly true and that by a number of different methods, but that the corrections obtained are effected by reversing the mechanical processes gone through at the time of the development of the deformity is an assumption for which there is very little support to be produced at the present time. Scoliosis is an unsolved problem etiologically. Its treatment is, and must necessarily be, purely empirical until its etiology is understood.

There is considerable evidence to support the view that there is a fundamental pathology for the deformity which may be concerned with bone physiology. Treatment directed to correction of the deformity by the application of force along mechanical lines will result in failure to effect a restitution to the normal in the great majority of cases, though more or less amelioration of the deformity may result, a part of which only will be permanent.

CHARLES F. PAINTER, M. D.

REPORTS OF SOCIETIES.

CLINICAL MEETING.

Baltimore, Mar. 5, 1913.

The Twenty-seventh Annual Meeting of the American Orthopedic Association opened with a clinical class in Baltimore. Dr. Wm. H. Howells, Professor of Physiology at Johns Hopkins University, gave a short talk on the composition of the blood in hemophilia based upon results obtained by him in an investigation of substances contained in the blood of patients suffering from this disease. The fibrinogen of the blood must be acted upon by another substance, which seems to belong to the Lecithin group in order that coagulation may take place normally. Anything interfering with the activities of this Lecithin, disturbs the coagulation process, rendering it in the hemophiliacs, too long (from one and one-half to five hours), or too short intervenous thrombosis. The average time of coagulability of normal blood is from twenty to forty minutes, when carefully aspirated from a vein. Howells has succeeded in extracting a substance from the juices of certain parts of the brain which looks as though it might be of practical value in reducing the coagulation period of hemophilitic blood. He does not consider that its value has been proven. He discussed the familial character of hemophilia from the standpoint of the Mendelian theory of heredity.

Dr. K. D. Blackfon demonstrated a child with myatonia congenita. Marked atony, asthenia and some contractures of the adductors and the biceps. Diaphragmatic respiration was very marked.

Dr. Sidney M. Cone reported on several cases in which he had employed injection of carbolic acid and alcohol in small doses (twenty drops) into joints affected by infection, more especially gonorrheal.

He reported very favorably in the few cases he had treated though the case shown was not convincing. Pain and disability, however, seem to have been quite decidedly lessened in these cases.

Dr. Rhoades Fairweather showed a case of Marie-Strumpell type of spondylitis deformans and discussed the theories as to its pathology, exhibiting a number of specimens demonstrating the difference between this and the more common osteo arthritis.

Dr. Harvey Stone gave a very interesting report of experimental work upon dogs which showed that isolation of a loop of intestine was accompanied by the speedy death of the animal with symptoms of profound toxemia. If the mucous membrane of the loop to be isolated was removed before isolation death did not ensue.

Dr. J. W. Williams showed three patients upon whom pubiotomy had been performed on account of sacral malformations of the type known as sacral assimilation.

Dr. Curtis F. Burnam discussed methods of using radium in the treatment of joint disease; he mentioned the French, German and English experience with this material and his own experience which as yet has not reached the good results reported abroad. Radium is given by the emenation method in a solution of alcohol. He does not feel that it offers very promising results.

Dr. Jose L. Hirsh discussed the compliment fixation test in gonorrhea. He believes an autogen should contain several strains of gonococci in order to be determinative.

Dr. H. Warren Buckler discussed postoperative toxemia and recommended the use of glucose and sodium bicarbonate before and after operation. This lessens or prevents the acetonuria which follows especially in children.

Dr. Randolph Winslow, Dr. Arthur M. Shifley and Dr. Robert P. Bay made some interesting remarks on fractures and their treatment and exhibited cases.

Dr. Frank Martin showed a case of osteomyelitis of the femur.

Dr. Sydney M. Cone showed some pathologic specimens of tuberculous bone lesions and rice bodies.

Dr. Compton Riely demonstrated his theory regarding the best position for retention of the hip in fixation in hip disease and applied a plaster-of-Paris spica to a child with the thigh in forced abduction, extension, outward rotation and the leg flexed, rotated inward and adducted on the thigh.

Dr. R. Tunstall Taylor showed some excellent results after tendon transplantation for poliomyelitis. Also some cases with modified Abbott Jackets which were applied on his own modification of Abbott's frame.

The James Lawrence Kernan Hospital and Industrial School for Crippled Children, at Radnor Park, Hillsdale, Md., was visited and the institution inspected.

The Children's Hospital School was also visited.

CENTRAL STATES ORTHOPEDIC CLUB.

The second meeting of the Central States Orthopedic Club was held at St. Louis on March 29, 1913.

The first clinic was held at the Children's Hospital.

Dr. T. C. Hemplemann presented a patient with orthostatic albuminuria. It was found that the function of the kidneyr was less when standing than when lying down.

Dr. Borden S. Veeder showed a case of hereditary cerebrospinal syphilis.

Dr. Ernest Sachs spoke on the results obtained from posterior spinal nerve root section for spasticity, and shown a case on which root section had been done.

Dr. Malvern B. Clopton showed a number of X-rays of patients operated upon for osteomyelitis.

Dr. Nathaniel Allison presented a number of cases treated by the Bradford abduction splint and showed the value of this method of treatment. He then demonstrated a number of cases of anterior poliomyelitis illustrating the late results in which the foot had been suspended by artificial silk ligaments. He also showed a number of old spastic cases in which the muscle groups had been isolated by nerve alcoholization.

Dr. Archer O'Reilly presented two cases of congenital syphilis; one a cervical spondylitis, the other an arthritis of the knee, which had been cured by neosalvarsan.

Dr. C. A. Stone showed a club-foot shoe and a club-foot wrench.

The second clinic was held at the Washington University Hospital.

Dr. Fred T. Murphy showed a case of multiple enchondroma, and also the result of bone plating.

Dr. Nathaniel Allison showed a traction table. He spoke on the operative treatment of Potts' disease and showed a case on which a Hibbs operation had been done. He followed this with a case of osteoarthritis in which there had been ankylosis of both hips. These joints were mobilized by the use of artificial membrane.

Dr. Barney Brooks showed joints from dogs in which the mobilization of joints by artificial membranes had been studied experimentally.

Dr. Archer O'Reilly showed X-ray pictures of syphilitic arthritis and presented three cases.

At the City Hospital, Dr. Alexander E. Horwitz presented some cases of lumbar and cervical Potts, syphilitic hydrops of the knee, sacroiliac disease, charcot joints, postoperative claw toe, and puerperal arthritis.

In the afternoon, Dr. Phil Hoffmann and Dr. F. H. Albrecht held a clinic at the Bethesda Hospital.

Dr. Hoffmann's operation for clawed toes was described with photographs and X-rays, and several patients were shown. Anatomical demonstration of cause of contraction of fascia lata. This was demonstrated in the cadaver. The power of the fascia lata as a flexor was shown on a case of infantile paralysis.

An osteoclast was shown which was a modification of the Grattan and an osteoclasis was performed.

A number of cases of spastic paralysis were shown which had been treated by extensive tenotomies.

A case of scoliosis was shown which had been treated by the Abbott method. A method of shaping and fitting cork arch supports was demonstrated.

On the trip from the Bethesda Hospital to St. John's Hospital, the members of the club were shown the new building of the Washington University Medical School.

At St. John's Hospital, Dr. Alexander E. Horwitz presented three cases of Volkmann's Ischemia Paralysis which had been helped by treatment, a case of spontaneous fracture in hereditary syphilis and a case of spastic paralysis.

The members of the club and their guests met for dinner at the University Club.

In the evening the scientific program was under the auspices of the St. Louis Medical Society. The first paper was by Dr. Alexander R. Colvin on "Fractures of the Tibia and Fibula at the Ankle-joint."

"The lesions occurring at the lower ends of the tibia and fibula are very varied in character, requiring the radiograph usually for differentiation, and a guide to treatment.

His own observations and perusal of illustrated literature on this subject, convinced him that Pott's fracture, in the strict sense, is a rare injury.

In a series of sixty cases occurring at the City and County Hospital, St. Paul, in the services of all the attending surgeons, the lesions were as follows:

1. Fractures of the external malleolus, or of the fibula above the joint, sixteen cases.
2. Fracture of the internal malleolus alone, four cases.

3. Fracture of both malleoli, twenty-seven cases.

4. Fracture of the internal malleolus, and of the fibula above the joint, combined with backward dislocation of the foot, three cases.

5. Fracture of the internal malleolus, and a splitting off of a junction, one case.

6. Split fracture of the tibia, at the tibio fibular junction, of minor degree, with no separation, one case (no other fracture).

7. Comminution of the articular surface of the tibia, one case.

8. Supramalleolar fracture, six cases.

9. Pott's fracture, fracture of the fibula and rupture of the internal lateral ligament, one case.

10. The most frequent lesion is a bimalleolar fracture, and the commonest deformity, is that of the everted foot.

11. The various lesions are produced by a predominating everting or inverting force.

12. These forces used as corrective measures in either direction, may result in the production of a deformity, the opposite to the one caused in the original injury.

13. Adduction or inversion of the foot is not necessary as a retention dressing, except in Pott's fracture, and if used in bimalleolar fractures, it is very liable to result in deformity.

14. Pott's fracture must be put up in adduction to approximate the torn structure at the inner side of the foot during healing."

The second paper was by Dr. Edward S. Hatch on "Some Interesting Lumbosacral and Sacroiliac Cases." This paper was based on a study of seventy-nine sacroiliac cases and twelve sacrolumbar cases. A limited description and classification of the sacroiliac cases was given, and it was found that in the seventy-nine cases, there were twenty-seven rights, twenty lefts, and thirty in which both joints were affected.

Seven sacroiliac cases were reported in detail, and the treatment was taken up briefly.

In the study of the sacrolumbar cases special mention was given of Dr. Goldthwait's work in this connection, and the impetus to the study of these cases that his papers had created.

The various anomalies of the fifth lumbar vetebra were described and six cases reported in detail which illustrated all these anomalies, in each of the cases reported the treatment used and its results were noted.

The paper was illustrated with lantern slides.

The third paper was by Dr. Frederick C. Kidner on "Possible Causes of Back and Leg Pain as Revealed by X-ray." Illustrated by lantern slides.

"As more is learned of the bony changes in the lower spine, more and more causes are found for chronic backaches and sciaticas. Many cases which have been unsuccessfully treated for sacroiliac disturbances are relieved when treatment is directed to deformities of the lower lumbar vertebræ; to strains of the lumbosacral joints and to injuries and disease, discoverable only by good X-rays of the lumbar vertebræ. Postural and exercise treatment of these lesions are most valuable. Each case must be treated individually after careful analysis of the lesion present. A number of X-rays of cases successfully treated along these lines were shown."

The fourth paper was by Dr. H. Winnett Orr on "The Treatment of Scoliosis by the Abbott Method."

Dr. Orr presented serial photographic negatives of fifteen patients, showing progress during treatment for scoliosis by the Abbott method:

"We are all more or less familiar with the methods formerly employed in the treatment of spinal curvature. We know how severe it was and the length of time necessary to secure what little we got in the way of results.

Moreover, we have not been accustomed heretofore to aim at anatomical correction of the deformity. Dr. Abbott was the first to impress us with the necessity for correction by rotation and that to obtain rotation treatment of the patients with the spine in flexions was necessary.

Dr. Abbott's method of securing this rotation with the patient in a flexed position by means of fenestrated plaster jackets, gives us all for the first time a comparatively simple and effective procedure by which the rotary correction may be obtained."

Dr. Orr's personal experience leads him to say that "while we may not all be able in a short time to secure the overcorrection of these deformities which Dr. Abbott has described, the Abbott method certainly offers us a chance for better results than we have been able to get heretofore."

In twenty-five patients treated during the past year, he has been able to obtain, even for the worst cases, more improvement and more actual correction of deformity that he obtained formerly, even for the easy patients of this class.

"It is my belief that Dr. Abbott has made a very important contribution to orthopedic methods and one which is destined to bring relief to many patients who have been looked upon as hopeless heretofore."

The fifth paper was by Dr. Roland G. Meisenbach (by invitation) on the Abbott treatment of scoliosis. Dr. Meisenbach spoke of the advantages of Abbott's method and of the ease with which correction could be obtained.

REPORT OF THE GERMAN ORTHOPEDIC CONGRESS IN BERLIN, MARCH, 1913.

A brief report of the Congress of the German Orthopedic Association held in Berlin the end of March may be of interest to American orthopedists, if only because its chief theme was the Abbott method of treating structural scoliosis. Dr. Abbott at the invitation of Professor Spitzy, chairman of the Congress, delivered the opening address. His paper well illustrated with stereoptican slides was in substance that of his article published in the New York Medical Journal of April 27, 1912. Dr. Abbott spoke in English with Professor Spitzy acting as interpreter. His address was followed by those of Professor Vulpius and Joachimsthal and of Dr. Erlacher, Spitzy's assistant, all of whom, after more or less extensive trial of the Abbott method, pronounced emphatically in its favor. That others were not equally well impressed was shown in the discussion which occurred the following day. Schanz attacked the method vigorously. Abbott's picture of the experimental scoliosis produced by immobilizing the medical student, Mr. Stanton, in a kyphotic position with the right shoulder elevated and brought forward, was, he claimed, not a true scoliosis but a thorax deformity which would have disappeared of itself within a few weeks. He saw great danger in employing the method, since thereby the treatment of structural scoliosis by means of corrective plaster jackets was bound to fall into disrepute and the profession relapse into the old, to him worthless, method of treatment by corrective exercises. The only rational method of treating structural scoliosis was, he maintained, by means of extension jackets. He presented a series of photographs showing the results which he has achieved by the extension method. (The same photographs will be presented at the International Congress in London this summer.) Wullstein seconded Schanz's opinions. Calvé stated that he had been trying the method during the last year, and that in his hands it had failed to give good results. Lange and Biesalski each asked a series of questions relative to the principle and the technic of Abbott's treatment—why anatomically the kyphotic position should be more favorable than the extended or lordotic, the exact nature and the duration of the after-treatment, and similar questions indicative of their interest and of their actual experience with the method. Neither expressed a definite judgment upon its merits.

Despite the impression of scepticism given by the discussion, practically the entire Congress attended an extra session in which Dr. Abbott demonstrated his method of applying a corrective jacket. Professor Vulpius had brought his American made "Abbott frame" with him for this purpose. The most intense interest was shown during the demonstration. Dr. Kofman of Odessa evidently voiced the general feeling when he asked Dr. Abbott to go slowly and explain every step. At the conclusion of the demonstration Dr. Abbott was greeted with applause and Spitzy thanked him in behalf of the German orthopedists for his contribution to orthopedic progress. Wullstein retracted much of what he had said the previous day. He saw many advantages in Abbott's method though he could not understand from his pathological studies why the kyphotic position should be preferable to the extended. He particularly favored Abbott's correction without previous mobilization exercises, since a laxity of the ligaments thereby produced was a distinct hindrance to the ultimate cure of the deformity. (This view distinctly at variance with that expressed in earlier meetings was, he stated, due to his experiences of recent years.)

Of the other papers of the Congress the most significant were those of Dr. Arthur Stoffel, former assistant of Professor Vulpius. In the first, dealing with the treatment of sciatica, Stoffel emphasized his previous work on the internal anatomy of nerve trunks. Sciatica must be thought of as a disease only of the sensory portion of the sciatic nerve, and only by a knowledge of the exact situation of these sensory tracts was a rational therapy by means of nerve section possible. In the second, a preliminary report on studies of tendon plastics, he called attention to important facts in the physiology of muscles. The muscle after a tendon plastic should not be subjected to more than the normal tension since otherwise its contractile power would be impaired. By a similar line of reasoning he argued that a tenotomy, which in reality shortens the muscle, must be considered an incorrect means of overcoming a spastic contraction. Also reefing a tendon so as to increase the power of an overstretched muscle was an illogical and unphysiological procedure since in reality it subjected the muscle to further stretching.

The discussion of arthritis deformans did not evoke the same lively interest as in the last American Orthopedic Congress. Preiser's paper reiterated the view already known to readers of his article in the AMERICAN ORTHOPEDIC JOURNAL in the August, 1912, number, that arthritis deformans is due to incongruence of the joint surfaces secondary to abnormal static conditions. Axhausen presented microphotographs of experimental arthritis deformans produced by eroding the joint cartilage in several places with an electric needle.

Of far more real interest to orthopedists were some of the papers of the Congress for Physio-therapy, notably those of Rollier, Wilms and Förster. Rollier showed pictures of his brilliant cures of tubercular joints and explained the method of heliotherapy practised by him at Leysin. Wilms, contending that heliotherapy could be advantageously practised only under certain climatic conditions, urged the use of Röntgen rays in the treatment of bone and joint tuberculosis. It was particularly significant to hear of another general surgeon who had abandoned the operative treatment of joint tuberculosis in favor of more conservative measures. Förster's address, probably the most scholarly of any delivered, presented the theory and the practice of the exercise treatment of paralyses, flaccid and spastic. By means of carefully graded exercises practised for months or even years Förster has achieved remarkable results in the treatment of conditions previously considered hopeless. His operation for spastic paralysis is to be performed only when the spasmodic contractions are too strong to permit treatment by exercises alone, and when performed it is merely the introduction to a long after-treatment.

LEO MAYER M. D., *Berlin.*

NOTICES.

COLLEGE OF SURGEONS.

An American College of Surgeons was organized at a meeting in Washington on Monday evening, May 5, 1913. Four hundred and fifty prominent surgeons of the continent of North America came together at the invitation of an Organization Committee which was appointed by the Clinical Congress of Surgeons of North America at its meeting in November, 1912. This committee consisted of Edward Martin of Philadelphia, Emmet Rixford of San Francisco, John B. Murphy of Chicago, Rudolph Matas of New Orleans, Albert J. Ochsner of Chicago, Charles H. Mayo of Rochester, Minn., Frederic J. Cotton of Boston, George Emerson Brewer of New York City, J. M. T. Finney of Baltimore, W. W. Chipman of Montreal, George W. Crile of Cleveland and Franklin H. Martin of Chicago.

The invitations, which resulted in this large gathering of surgeons in Washington, were extended by the Organization Committee after a carefully prepared campaign in which each large university city on the continent was visited by a member of the committee who met, in person, a group of selected men brought together by a committee of three in each locality, which committee had been authorized by the Organization Committee to extend an invitation to the surgeons in their locality to meet the representative of the Organization Committee. These five hundred men who were invited to the meeting in Washington, four hundred and fifty of whom responded, represented all branches of surgery and surgical specialties. The surgeons responding to the invitation were designated the Founders of the College.

BY-LAWS.

The interest in the By-laws centered in: 1. The name. 2. The object. 3. The forming of the organization. 4. Its administrative plans. 5. The meaning of the fellowships. 6. Fees. 7. Directory. 8. Expulsion. 9. Standing committees.

I. *Name.*—The name of the corporation is the College of Surgeons.

II. *Object.*—The object of the College shall be to elevate the standard of surgery, to provide a method of granting fellowships in the oganization and to formulate a plan which will indicate to the public and the profession that the surgeon possessing such a fellowship is especially qualified to practise surgery as a specialty.

III. *Organization.*—The corporation is to be known as the College. The College shall consist of all members of the corporation, to be known as Fellows, and shall vest the general management of the corporation in a Board of Governors, and the Board of Governors shall in turn vest the details of the management in a board of trustees, to be known as the Board of Regents.

IV. *Administrative Plans.*—1. The Board of Governors shall consist of the five hundred surgeons invited by the Organization Committee to serve as founders of the College and who have signified their willingness to act in that capacity. The individuals of the first Board of Governors shall also be known as the founders of the College of Surgeons.

This original Board of Governors shall be divided into three classes to serve one, two and three years. At the annual meeting in 1914 and at each succeeding annual meeting, the Fellows of the College shall elect fifty surgeons to membership in the Board of Governors, each for a term of three years. Thirty of these are to be elected from a list of nominations consisting of two members each nominated by the following surgical societies and associations of North America:

American Surgical Association. Section on Surgery of the American Medical Association. Section on Obstetrics, Gynecology and Abdominal Surgery of the American Medical Association. General Surgical Division of the Clinical Congress of Surgeons of North America. Division of Surgical Specialties of the Clinical Congress of Surgeons of North America. American Gynecological Society. Southern Surgical and Gynecological Association. Western Surgical Association. Section on Surgery of the Canadian Medical Association. American Association of Obstetricians and Gynecologists. American Orthopedic Association. American Association of Genitourinary Surgeons. American Laryngological Society. American Ophthalmological Society. American Otological Society.

Twenty members shall be elected at large to represent surgeons of North America not affiliated with the above societies or associations.

The Board of Regents shall consist of twelve surgeons, members of the Board of Governors, elected by the Governors, these to be divided into three classes whose terms of service shall expire in one, two and three years. Their successors shall be elected each for a term of three years. Not more than three of each class of four shall be elected from one country. The Board of Regents is increased to fifteen in number by three officers of the Corporation, the President, Treasurer and General Secretary. The two Vice-presidents are ex-officio members of the Board. The Board of Regents is the administrative body of the corporation, corresponding to a board of trustees in other corporations.

V. *Fellowships.*—The Fellows of the College shall be graduates in medicine, who are legalized to practise medicine in their states and provinces, who have made an application for fellowship, such application to be endorsed by three Fellows of the College, one of whom shall be a member of the Board of Governors, and who meets the qualification requirements that shall, from time to time, be established by the Board of Regents, and who shall be elected to Fellowship by the Board of Regents on recommendation of the Committee on Credentials.

All Fellows of the College shall be designated a Fellow of the College of Surgeons and shall be authorized and encouraged to use the letters F. C. S. after his name on professional cards, in professional directories and in scientific articles published in surgical literature.

VI. *Fees.*—An initial fee of Twenty-five Dollars shall be required of each member of the College on his election to fellowship by the Board of Regents. The annual dues will be Five Dollars.

VII. *Directory.*—The Board of Regents shall issue each year a directory containing the names and addresses of the Fellows of the College of Surgeons, arranged by states, provinces and colonies.

VIII. *Expulsion.*—Any member of the College may be expelled for unprofessional or other conduct inconsistent with the rules and regulations of this Corporation by a majority vote of the Board of Regents.

IX. *Standing Committees.*—The Board of Regents shall elect the following standing committees: 1. Credentials. 2. Legislation. 3. Graduate Schools and Hospitals.

These by-laws were unanimously adopted with the provision that the Board of Regents should make any minor corrections deemed desirable and present such corrections for adoption at the next meeting of the Board of Governors.

OFFICERS ELECTED.

President, J. M. T. Finney, Maryland; First Vice-president, W. W. Chipman, Quebec; Second Vice-president, Rudolph Matas, Louisiana; Treasurer, A. J. Ochsner, Illinois; General Secretary, Franklin H. Martin, Illinois.

BOARD OF REGENTS.

J. M. T. Finney, Maryland; A. J. Ochsner, Illinois; Franklin H. Martin, Illinois; George E. Brewer, New York; George E. Armstrong, Quebec; John B. Murphy, Illinois; Edward Martin, Pennsylvania; F. J. Cotton, Massachusetts; Herbert A. Bruce, Ontario; C. F. Stokes, Washington, D. C.; William D. Haggard, Tennessee; George W. Crile, Ohio; Robert E. McKechnie, British Columbia; Charles H. Mayo, Minnesota; Harry M. Sherman, California.

SELECTION OF FELLOWS.

Much interest was manifested in the method to be pursued in the selection of the members of the Corporation and in the method of conferring fellowships. A series of resolutions covering this subject were offered by the Secretary and adopted.

The prospective Fellows are to be divided into four classes, A, B, C and D. Classes A, B and C are by resolution to be admitted without the formality of submitting to an examination under the following resolution:

"*Resolved*, That the A class shall consist of founders of the College.

"The B class shall consist of the members of the special surgical societies constituting the Congress of American Physicians and Surgeons and one hundred each, nominated by accredited committees, from the Surgical Section of the American Medical Association, from the section on Obstetrics, Gynecology and Abdominal Surgery of the American Medical Association, from the General Surgical Section of the Clinical Congress of Surgeons of North America, from the Division of Surgical Specialties of the Clinical Congress of Surgeons of North America, from the American Association of Obstetricians and Gynecologists, from the Surgical Section of the Canadian Medical Association, from the Southern Surgical and Gynecological Association and from the Western Surgical Association.

"The C class shall consist of surgeons of prominence of five years in the practice of surgery or a surgical specialty and who, in the opinion of the Committee on Credentials, are eligible for fellowship in the College without formal examination."

For all others, coming under class D, the following resolution was passed:

"*Be It Further Resolved*, that the Board of Regents, through the Committee on Credentials, limit the admission of the Fellows to classes A, B and C until the Board of Regents formulates a standard of requirements for class D and reports the recommendations back to the Board of Governors for approval at the meeting to be called by the Board of Regents in Chicago, November, 1913."

APPLICATIONS FOR FELLOWSHIPS.

It will be the spirit of this Association to open the fellowship to all competitors in surgery without favor. Scientific attainments, surgical ability, unquestioned moral character, measured by the College's standards, shall constitute the measure for fellowship.

There are many hundreds of surgeons on the continent, who are not included in classes A and B, who fall into the C class. Applications from these men will be welcome and their names will have the most careful consideration by the Committee on Credentials.

All applications for membership should be forwarded to the Secretary of the corporation. It would add to the ease of the work of the Committee on Credentials if references in the way of vouchers or recommendations from one or more well known surgeons accompany each application for fellowship.

FORMAL CONFERRING OF FELLOWSHIPS.

The first convocation for the formal conferring of fellowships will occur in November, 1913, at a time and place that will be designated later. The first directory of Fellows will be distributed at that meeting. For that reason the applications for fellowships on the part of A, B and C classes should be filed as promptly as possible in order to facilitate the correcting of lists for publication.

BOOK REVIEWS:

A TREATISE ON MASSAGE. BY DOUGLAS GRAHAM. Fourth Edition. J. B. Lippincott Company, 1913.

To the American people, whether lay or professional, the term massage has but little significance except that of rubbing. Its importance as a measure of therapeutic value is but slightly appreciated. Interest in the subject is growing, and that this is true is to large measure due to the efforts of Dr. Graham, the author of this book now entering upon its fourth edition.

A careful revision of the previous work with the addition of some new text and several new illustrations had increased the value of the book to the general practitioner as well as to the professional masseur. Dr. Graham's efforts to bring to the public the benefits that may be derived from massage have not been confined to personal ministrations to his patients, but have taken the form of educating others in the art of which he himself is so successful an exponent. Not the least important of these educational endeavors is the promulgation of the principles and practices of massage within the covers of his volume. It should be in the hands of all who are seriously contemplating the study of the subject, and its perusal will furnish much food for thought to those practitioners of medicine who are awakening to a realization of the importance of physical therapy in the treatment of disease.

ABSTRACTS.

I. TUBERCULOUS LESIONS OF BONES, JOINTS AND TENDONS. GENERAL ARTICLES ON TUBERCULOSIS.

An experimental Study of Bone Growth and the Spinal Bone Transplant. By Fred H. Albee, M. D., *Journal A. M. A.*, April 5, 1913.

Thirteen experiments are reported, and conclusions are drawn from them and from the author's operations on the human subject.

A great deal of liberty can be taken with the bone graft, and the transplant acts as a stimulant to osteogenesis on the part of the bone in which it has been implanted. Bone with the periosteum removed was as satisfactory as that in which the periosteum had been retained. In one experiment a piece of sheep's bone was transplanted into the spine of a dog but it did not unite.—Edward S. Hatch, New Orleans.

Joint Tuberculosis. By Leonard Ely, Denver. *Berl. klin. Woch.*, Feb. 10, 1913, p. 256.

The article sets forth the author's ideas, so well known through his book and other writings, that primary joint tuberculosis exists in the synovia and lymph marrow. These tissues do not exist in a joint having no function, and conversely the disease cannot exist in a joint deprived of function, as by a radical operation. Conservative treatment is advised however in children. The dangers of secondary infection on top of the tubercular process are emphasized. His theory is that the relation between the lymph cell and the tubercle bacillus is distorted so that the cell is destroyed by the bacillus, as is the red blood cell by the malarial plasmodium. The article is well illustrated by microphotographs and X-ray prints.—*Roland Hammond, M. D., Providence., R. I.*

Report of Ten Cases Operated upon for Pott's Disease of the Spine by Albee's Method of Bone Grafting. Rugh. *International Clinics* Vol. 1, 23rd Series, 1913.

The author reviews the history of operative procedures in the treatment of Pott's disease; and then describes the technic of Albee, which Rugh used in the ten cases he reports. After a discussion of his cases he concludes: (1) The operation is simple and without shock and may be employed even when the general vitality of the patient is low. (2) Fixation of the spine in the diseased part is secured. (3) A plaster-of-Paris jacket should be used after the operation. This may be succeeded after a few months by a brace. External support should be maintained for at least eight months. (4) This operation is almost ideal from surgical and mechanical points of view, and it enables the patient to become a wage earner (if an adult) after one or two years of treatment instead of after the six or more years required by the usual treatment by casts and braces.—*A. Bruce Gill, Philadelphia.*

The Treatment of Surgical Tuberculosis by Hyperemia. By Bier. *Zentalbl. f. Chir.*, 1912, 40. Abstract in *Ztschr. f. orth. Chir.*, Bd. XXXI, H. 1-2, p. 302.

Bier recommends his methods of treatment by local hyperemia in surgical tuberculosis. He combines with this the internal administration of iodide of potassium.—*A. Bruce Gill, Philadelphia.*

Sunshine Treatment of Tuberculosis of Bones and Joints. By Bardenhauer. *Strahlentherapie*, Bd. II, p. 211. Abstract in *Ztschr. f. orth. Chir.*, Bd. XXXI, H. 1-2, p. 300.

Bardenhauer treated forty-six cases of surgical tuberculosis after Rollier's method during the years 1911 and 1912. He found the treatment of great value, leading often to cure of cases that had resisted all other forms of treatment. It seemed especially valuable in cases that had been long treated by operative and hygienic measures without result.—*A. Bruce Gill, Philadelphia.*

The Sunshine Treatment of Tuberculosis. By Rollier. *Wiener klin. Wochenschr.*, 1912, No. 28. Abstract in *Ztschr. f. orth. Chir.*, Bd. XXXI, H. 1-2, p. 299.

Sun baths are of great value in treating surgical tuberculosis. The effective factors of the Alpine climate are the greater intensity of the ultraviolet rays of the sun, the dryness of the atmosphere, and the greater bactericidal action of the sunlight, the greater length of days in the summer, and in winter the reflection of the sunlight from the snow and ice. The high altitude also produces a tonic effect upon the patient.

The first effect of the sun baths is the pigmentation of the skin, which is due to the ultraviolet rays. The resistance of the patient and the rapidity of his recovery are proportional to the skin pigmentation. The hyperemia produced by the sun's rays is also an important factor in the cure. The author's experience with this treatment has extended over nine years and has included seven hundred cases. In all cases of surgical tuberculosis improvement or cure may be expected. Cold abscesses are often spontaneously absorbed, and diseased joints resume their normal functions. One of the first effects of the sun's rays is the lessening of pain. Then tuberculous foci are softened and bone sequestra are extruded. Tuberculous peritonitis also is very favorably affected by this treatment.—*A. Bruce Gill, Philadelphia.*

The Relation of Trauma to Bone Tuberculosis. By H. Augustus Wilson, M. D., Professor of Orthopedic Surgery, Jefferson Medical College, Philadelphia; and Randle C. Rosenberger, M. D., Professor of Hygiene and Bacteriology, Jefferson Medical College, Philadelphia. *New York Medical Journal*, June 14, 1913.

Wilson and Rosenberger critically analyzed the clinical and histological aspects of the relation of trauma to bone tuberculosis. Animal experiments and clinical experience, together with a review of the literature, fails to reveal any logical connection between trauma and bone tuberculosis.

Histological studies are convincing that the progress in inflammation is antagonistic to tuberculosis, thus confirming the clinical observation that tuberculosis never accompanies, or follows, fractures, sprains, or other severe injuries. It is purely theoretical to look for slight injuries, like bruises and contusions, because there can be no sound basis for their consideration.

The animal experiments of many investigators have clearly proven that infection has produced tuberculosis where no trauma was used, and frequently demonstrated that the injured joints were less frequently involved in tuberculosis than the uninjured joints. Clinical experience proves that trauma is often trumped up, or its occurrence often directs attention to a previously existing tuberculosis.

Infestation differs from tuberculous infection and therefore whatever lowers the vitality of the patient and diminishes resistance become potent factors in the retrograde progress of bone tuberculosis, and thus bring into conspicuous prominence a latent tuberculosis. Conversely, whatever produces active circulation, greater powers of resistance, increased recuperative ability, will induce recovery from tuberculosis by the process of walling-in.

It is impossible to determine upon any rational basis that trauma bears any other relation to tuberculosis than a coincidental condition.

II. PARALYTIC DISEASES AND THEIR DEFORMITIES. NERVE LESIONS WITH ARTHROPATHIES.

Indications for Arthrodesis in Paralytic Cases. By William Böcker, Berlin. *Deut. medizin. Woch.*, March 6, 1913, p. 458.

The author agrees with Robert Jones that arthrodesis before the tenth year is inadvisable. He opposes the opinion of Hoffa that all three joints of a limb should be stiffened. Varus and valgus positions of the foot, and flexion of the hip and knee are often observed when the ankylosis following arthrodesis is fibrous. Arthrodesis of the ankle gives a firmer support than tendon transplantation, and in the case of flail joints allows apparatus to be dispensed with. "Arthrodesis of the hip is uncertain and interferes with the sitting position; stiffening of the knee is permissible that of the ankle is recommended." If both legs are involved, only one side should be stiffened and apparatus used on the other leg. Arthrodesis of the shoulder is recommended by most surgeons, but never the elbow. The wrist is better fixed by tendon transplantation. Apparatus should be worn for one or two years after arthrodesis. In some cases apparatus tends to give the patient a more serviceable extremity, in other cases an operation is best. In severe paralysis, apparatus should not be neglected. —*Roland Hammond, M. D., Providence, R. I.*

Treatment of Poliomyelitis. By Geo. E. Malsbary. *International Clinics*, Vol. I, 23d Series, 1913.

1. *Prevention of the Spread of the Disease.*—Cases of poliomyelitis should be strictly quarantined, and the presence of flies should be prevented by the use of screens and their breeding places should be destroyed. Poliomyelitis is an infectious disease as indicated by the facts that it occurs in epidemics and tends to spread along the lines of travel, and as proved conclusively by inoculative experiments in animals. It seems quite likely that the stable fly is a carrier of the virus. In the recent

epidemic of the disease in Los Angeles the establishment of rigid quarantine very quickly terminated the epidemic.

2. *Ridding the Body of the Virus.*—The virus is commonly present in the nasopharyngeal mucous membrane. A solution of 2 per cent. hydrogen peroxide and 0.5 per cent. menthol will destroy the virus if brought in contact with it. This solution should therefore be used in frequent cleansing of the nose and throat of the patient. Active catharsis should be employed to eliminate any virus present in the gastrointestinal tract, as the virus has been found in mesenteric lymph glands. Hexamethylenamine should be freely administered for the sake of its antiseptic action in the cerebrospinal fluid and in the saliva and other secretions.

3. *Treatment of Early Pathological Changes.*—Inflammatory exudate and infiltration of lymphocytes within the meninges and within the brain and cord kill the ganglion cells by cutting off their nourishment by pressure. It seems likely that this inflammatory process may be favorably influenced by counterirritation over the spine. Hot baths, ice bags, blisters, cups, leeches, iodine, etc., may be employed. For any toxic action of the virus upon the ganglion cells nothing can be done.

4. *Treatment of Symptoms.*—Fever above 103° should be combatted by the use of a hot bath. Ice caps may be used along the spine. Pain and nervous symptoms may be treated by baths, salicylates, and phenacetin. Absolute rest in bed is essential. Heart stimulation may be necessary. The bowels should be kept freely open.

5. *Prevention and Treatment of Paralysis and Deformity.*—Massage should be employed as soon as the acute symptoms have disappeared. Electricity to the spine and to the extremities and active and passive movements should then be begun and continued persistently for at least a year. The general hygienic treatment should leave nothing to be desired. Deformities should be prevented by avoiding pressure of bedclothes upon the feet, by maintaining the affected extremities in correct position by various mechanical contrivances. If deformities occur they are to be treated by the means employed by orthopedic surgeons.

The physician must above all be patient and persistent and give no case up as hopeless.—*A. Bruce Gill, Philadelphia.*

A report of Ninety-nine Cases of Paralysis Occurring during Sleep.

By Lewinsohn. *Diss. Breslau*, 1912. Abstract in *Ztschr. f. orth. Chir.*, Bd. XXXI, H. 1–2, p. 287.

Paralysis occurs from pressure on certain nerves while the person is asleep. Of the ninety-nine cases reported by the author, eighty-one were cases of paralysis of the radial nerve, twelve of the ulnar, four of the median, one of the radial, median and ulnar nerves, and one of the peroneal nerve. This apparent predilection of the radial nerve to pressure paralysis is due to the not uncommon custom of sleeping with the head on the arm and also is due to the fact that the radial nerve is in close relation to the humerus for a long distance and is poorly protected by a thin layer of overlying tissues.

Alcoholism plays an important rôle in these paralyses in two ways. It injures the nerves so that a comparatively slight trauma may cause paralysis. In the second place, a drunken person sleeps so soundly that he is not wakened by the pain and numbness that precede the stage of paralysis from pressure. In a smaller number of cases other intoxications such as lead poisoning and toxemia from bacteria predispose to pressure paralysis.—*A. Bruce Gill, Philadelphia.*

Artrhodesis of the Ankle-joint. By Max Schönenberg. *Ztschr. f. orth. Chir.*, Bd. XXXI, H. 1–2, p. 17.

The author thinks that the operation of arthrodesis has recently been, more or less neglected in favor of transplantation of tendons in correcting deformities of the foot. He reviews the history of the operation from the time that it was first employed by Albert in 1878. There is a diversity of opinion among surgeons today as to the value of this operation and as to the indications for it and the method of performing it.

In possibly 40 to 50 per cent. of the cases only a fibrous instead of a bony ankylosis results from the usual methods of performing the arthrodesis in children. In children under ten years of age fibrous union is the rule. To avoid this result Cramer in 1910 performed arthrodesis of the ankle-joint by combining a transplantation of a flap of periosteum and bone with the usual method of denuding the joint surface. The following method according to Cramer's principles has been employed by the author in Prof. Garre's clinic in Bonn:

From the crest of the tibia a thin layer of bone 10 to 12 cm. long covered with its periosteum is chiseled away and placed in physiological salt solution until required. A saggital incision 12 cm. long is made on the dorsum of the foot over the ankle-joint. The tendons are held aside. The periosteum on the tibia and the tarsal bones is split in line with the skin incision and is freed from the bones and pushed aside. The underlying bones are scraped with a sharp spoon and the periosteum-bone transplant is laid upon them with the bony layer of the transplant down. The periosteum of the tibia and the tarsal bones are then sutured over the transplant or to it. The skin wound is closed, the foot is placed in the corrected position and dressed in plaster of Paris. Schönenberg reports nine cases treated in this manner and shows the X-ray pictures of each. The results were apparently good.

The author reaches the following conclusions regarding arthrodesis of the ankle:

1. It is possible to secure ankylosis of the foot by transplanting bone and periosteum as above described.
2. This method gives bony ankylosis in children under eight years of age.
3. The fixation grows stronger as the transplant increases in size.
4. A free periosteum-bone transplant usually grows fast, but a transplant having a pedicle has the best chance for life.
5. A broad and thick transplant is probably the best to employ.
6. The combination of the usual joint denudation method with the transplantation method will give a quicker ankylosis than either method alone.
7. One can compensate for shortening of a limb by ankylosing the foot in plantar flexion.—*A. Bruce Gill, Philadelphia.*

Plastic Operations on Nerves. By Bade. *Ztschr. f. Krüppelfürsorge*, Bd. IV, H. 2–3. Abstracted in *Ztschr. f. orth. Chir.*, Bd. XXXI. H. 1–2, p. 290.

While tendon transplantation has proved to be of very great value, yet nerve transplantation is indispensable in certain cases. In such cases it is absolutely necessary that the muscles be capable of function. Therefore this method is not applicable to the great group of cases of anterior poliomyelitis, where there is degeneration of muscles accompanying the paralysis.

But cerebral hemiplegias with their accompanying conditions, and especially radial paralyses offer a fruitful field for plastic nerve operations.

The author envelops the sutured nerves with a piece of artery of a dog or a calf hardened in formalin.

Movement of the paralyzed muscles is usually observed in two or three months, and full motion is possible within five to nine months after the operation.—*A. Bruce Gill, Philadelphia.*

Tendon Transplantation in the Treatment of Infantile Spinal Paralysis—Indications, Technic, Results. By Vulpius. *Deutsche med. Wochenschr.*, 1912, No. 36.

The author states that tendon transplantation should not be done until at least a year has elapsed since the onset of the disease. Muscles which show no power of active contraction at the end of a year are to be considered as dead, and tendon transplantation may be then immediately considered for the cure of the deformity. A small incision made over any muscle will reveal the condition of the muscle by means of its color. The author then considers the indications for transplantation at the various joints and presents his technic.—*A. Bruce Gill, Philadelphia.*

Poliomyelitis and Variola. By Frederick Proescher, Pittsburg. *New York Med. Journ.*, Vol. XCVII, No. 15, April 12, 1913, p. 741.

This paper is an elaborate bacteriological study as to the etiology of the two diseases from their bacteriological standpoint. It also discusses at length their various staining characteristics, and the methods for their employment. The article is chemical and bacteriological and is probably of value and interest to one versed in that subjeect.—*James Warren Sever, Boston.*

Acute Anterior Poliomyelitis Following Bite of Dog Infected with Rabies. By Hubert B. Haywood. *New York Med. Jour.*, Vol. XCVII, No. 15, April 12, 1913, p. 771.

A report of a case of anterior poliomyelitis coming on two weeks after a dog bite. The dog was killed and found to have rabies. The boy came down with the disease during the course of the Pasteur treatment. This is an interesting report but does not prove in any way that the paralysis was due to the dog bite.—*James Warren Sever, Boston.*

To Abolish or Diminish the Period of Postoperative Immobilization in the Transplantation and Fixation of Tendons. By Dr. Putti.

Having performed a tendon transplantation, it is customary to immobilize the operated part in plaster of Paris for a period of time which experience has demonstrated must not be less than six weeks. This period is a necessity which cannot be lessened inasmuch as a long period of repose is necessary in order that the transplanted tendon be solidly fixed to the part which receives the transplant.

It is nevertheless true that immobilization causes damage, in part through the atrophy which is induced in all the elements of the extremity, with special damage to the muscle and to the tendon which has served as the transplant; also in part through adhesions which inevitably are established between the element transplanted and the walls of the new canal through which it is destined to run. In fact, it is seen on reoperating parts in which tendon transplantations have been done that one of the most frequent causes of nonsuccess lies in the tenacious and diffuse adhesions, which limiting or abolishing the sliding of the tendon and the contraction of the muscle-belly removes the possibility in one way or the other of their fulfilling function.

Various methods have been sought to avoid this serious difficulty. Lange has suggested passing the tendon through a very superficial path, preparing for it a canal in the layer of subcutaneous adipose tissue. Biesalsky has advised preserving the tendon with its sheath and transplanting them together. Neither method is free from criticism. The adipose tisues has almost never sufficient thickness, especially in the paralyzed extremities of children, to completely cover the tendon. Furthermore, the tendon placed in close proximity to the skin has a great tendency to form adhesions with it. The method of Biesalsky has a value purely theoretical because technically it is almost impossible to preserve completely the sheath of the tendon. Furthermore, if either method could succeed in preventing adhesions there is nevertheless the serious danger of atrophy due to inactivity.

To me it seems that the most direct way of arriving at the desired end, that is of preserving to the transplanted part all its original vitality and of avoiding its adhesions with the surrounding parts, should lie in diminishing or abolishing completely the period of immobilization. The reason on account of which recourse has not yet been taken to this simple and logical method lies undoubtedly in the fact that technical methods of union of the tendon to its new surface of attachment are not such as to guarantee immediately fixation sufficiently solid to remove the necessity of immobilization.

The so-called method of transplanting from tendon to tendon has been abandoned by practically all. The method which can be said to be universally adopted is that of the Periosteal Transplantation of Lange. Codivilla, as is known, has made more expeditious and secure the technic of Lange, fixing the tendon's extremity to the skeleton by passing it under a periosteal bridge using in place of silk sutures little metallic nails. While periosteal or subperiosteal fixation makes a definite technical advance, it does not yet represent the ideal security of attachment for which we are seeking. The periosteal layer to which the extremity of the tendon is fixed and the osteoperiosteal bridge under which it passes are fragile and it is necessary that a long time elapse before the fusions between the periosteum, tendon and bone form a union sufficient for the strong tractions that the tendon exercises on the point of its insertion.

In the foot where transplantations are more frequently done, the thickness and the resistance of the periosteal covering and of the bone vary with the varying parts and with the trophic condition of the part and with the age of the subject. The metallic nails of Codivilla like the little screws which I have substituted for them induce almost constantly an atrophy, so that in a brief time the bony canal in which they are fixed enlarges and the nails and the screws do not resist the contractions made by the muscle. An abrupt movement made by the patient, the tendency that the foot has to resume shape early following the operaton, the incorrect position that the tendon or the transplanted tendons have to overcome, the action itself, the weight of the part that depends almost entirely upon the newly transplanted tendon are important factors of the displacement and detachment of the tendon from its new insertion. Hence the necessity for prolonged immobilization with all the dangers which are coincident with it, and therefore I have studied to find a means that giving absolute guarantee of a solid fixation of the tendon to the skeleton will permit of diminishing or better yet of abolishing the period of postoperative immobilization.

In place of grafting the extremity of the tendon to the surface of the bone, making use of drills of vaious diameter or of a rigid metallic sound, I pass the complete tendon through a canal made in the bone or in a case of the foot through a space between the metatarsals to the plantar surface. Hence making use of a little opening made in the skin of the plantar surface I pass the tendon back again encircling thus the base of a metatarsal or one of the entire bones of the tarsus. In the first instance it is not necessary to make any bony tunnel, making use of the interspaces between the bones. In the other instance it is necessary to prepare two canals one to serve for passing it down and the other to return the tendon. The bone being thus encircled, the extremity of the tendon is sutured to its proximal portion with a few sutures of silk or linen.

Not all tendons are adapted to this method, but only the longer ones, which are sufficiently long to encircle the bone. But of the five tendons of the foot that are most frequently used in transplantation three are well adapted for use, *i.e.*, the long flexor and the long extensor of the great toe and the long peroneal, provided it is detached from the plantar surface of the foot or at its metatarsal insertion. It may be noted that the long flexor of the great toe is a muscle that is very often not affected in infantile paralysis against which it seems to have a certain immunity. It is also possible to make use of the two tibial muscles by lengthening them with an artificial tendon.

We have operated with the above described method five paralytic feet due to infantile paralysis, and in the five cases we have not had recourse to immobilization with plaster. The results have been very encouraging.

From the illustration given it is possible to observe the result obtained in one of these cases. It was an equinovarus foot of marked degree in a girl of fifteen years. The tibialis anticus and the pronators were paralyzed. The Achilles tendon was shortened and the patient walked on the external border of the foot. Under anaesthesia having corrected manually the deformity and lengthened the Achilles tendon I divided the tendon of the long extensor of the great toe at the level of the metatarso-phalangeal articulation. First having sutured the distal portion of the tendon to the tendinous division of the common extensor to the second toe, making use of an incision upon the outer surface of the middle third of the leg, I passed upward the proximal portion of the tendon and threaded it into the sheath of the common extensor. Having done so to carry the tendon to the dorsoexternal region of the foot where I made a small skin incision I passed the extremity of the tendon through the space between the fourth and fifth metatarsals and made it encircle the base of the fifth metatarsal from within outward and fixed it in proper tension with a few linen sutures to its central portion. Ordinary dressing. After fifteen days the patient began to walk. The photograph made three months after the operation shows very well how the foot can be actively carried into dorsal flexion and into pronation. The valid contraction of the muscle belly and the tension of the transplanted tendon during voluntary movements can be easily felt on palpation.

Tendon fixation, otherwise called tenodesis, originated and done by Codivilla in 1900, is an operation whose application is found in extremities affected by flaccid paralysis and in which through the absolute lack of muscular elements it is not possible to do tendon transplantations. In a flail foot, for example, the tenodesis replaces arthrodesis, an operation uncertain in outcome and of limited application.

Tendon fixation of the foot done according to the technic of Codivilla consists in uncovering the tendons of the anteroexternal region in raising them from their bone and ligamentous groove in separating the periosteum from the bones underneath and in excavating in the bones themselves a sulcus adapted to receive the tendons. Having seated these in the bony grooves the periosteum is sutured over them. Between the tendons, bones and periosteum there is thus established with the passage of time an intimate union which ought not to allow to the tendons any displacement. And this displacement will not occur in reality if great care is taken that for a long time the part is immobilized with plaster. Experience has demonstrated that three months of immobilization are necessary.

Every one understands how this long period of immobilization is detrimental to the trophic condition of the tendons. I have considered how to obviate the inconvenience of the long period of immobilization seeking a method of fixation of the tendons to the skeleton which from the earliest moments shall be secure. Having exposed by a long cutaneous incision the tendons of the anteroexternal region of the leg and raised them from their groove, they are divided a little above their point of passing into their muscular portions. Having exposed at a point the shaft of the tibia and having made at the same level two little incisions in the periosteum which covers its external and internal faces a tunnel is made through the entire thickness of the bone. Into the lumen of the canal so made some of the tendons that one wishes to fix are introduced and to their free extremity on coming out from the opening, under the necessary tension to maintain the foot in correct position, one sutures with a strong ligature of linen, reinforced with other sutures, the free extremity of another of the tendons which is to be used in the fixation. The point of union of the tendons is covered with a layer of periosteum.

In this way there is made a strong tendinous loop which has a very solid point of attachment in the entire thickness of the tibia. Ordinarily we pass into the bony canal the tendons of the long extensor of the great toe and of the extensor of the toes and at the point of exit we unite with them the tendon of the tibialis anticus. Furthermore when one sees the desirability and if a bony canal of sufficient size is made, it is possible to insert also the tendon of one of the peroneals, providing in this way not only for the doral flexion of the foot, but also for the pronation of the foot.

In the four cases operated by this method, we have left in place the immobilizing apparatus for two weeks. The position of the foot has been well maintained and the resistance of the tendons and of their attachment to the skeleton, even under strong traction has been demonstrated as excellent.

Epidemic Poliomyelitis, Fourteenth Note; Passive Human Carriage of the Virus of Poliomyelitis. By Simon Flexner, M. D., Paul F. Clark, Ph. D. and Francis R. Fraser, M. B., New York. *Journal A. M. A.*, Jan. 18, 1913.

Nasopharyngeal irrigations of both parents of a child suffering from infantile paralysis were injected into a monkey; the monkey contracted the disease. A glycerinated emulsion of the spinal cord of this monkey was later injected into two other monkeys both of which had the disease. This would seem to prove beyond a doubt that healthy human carriers exist.—*Edward S. Hatch, New Orleans.*

Experiments on the Cultivation of the Virus of Poliomyelitis. Simon Flexner, M. D., and Hidago Noguchi M. D. *Journal A. M. A.*, February, 1, 1913.

These cultivations have been conducted both with filtrates and with tissues in substance.

Monkeys were inoculated with the cultures and have had the disease. Experiments are now being carried on with later generations of these cultures.—*Edward S. Hatch, New Orleans.*

Genesis and Treatment of Occupational Cramps, Etc. By Tom A. Williams, M. B. C. M. Edin., Washington, D. C. *Jour. Neurol. u. Psychol.*, Leipsig, 1912, Bd. XIX.

The true professional neurosis is psychogenically perpetuated, even though the disability may at first have been physical.

Cases are studied and cited to show this.

Among these are (1) a right torticollis with cramp of the right arm while counting money. The mechanism is that of an ideogenetic affect producing a tonic tic, a dyskenesis which interferes with the occupational act.

The pathogenesis was traced to an unpleasant incident with a fellow employee who sat behind and to the right.

Great improvement for a time.

(2) Refused treatment and had to change occupation of bookkeeper.

(3) A paymaster cured as result of one interview which traced the psychological mechanism to an anxiety induced by the refusal of a check.

(4) A woman who always hated letter writing cured in four months. See also N. Y. Med. Jour., Feb. 8, 1913.

(5) A complex case of multiple cramps cured after six months.

(6) Several telegraphers were studied also.

In no case was a sexual factor found in the genesis.

Treatment, after psychoanalysis, consisted of psychomotor discipline followed by reeducation of the professional act.—*Author's Abstract.*

III. METABOLIC DISTURBANCES CAUSING BONE AND JOINT DISEASES. INFECTIOUS ARCHTITIS, OSTEOMYELITIS, ETC.

Pathology of Typhoid Spine. By Mark Rogers. *Boston Med. Surg. Jour.*, Vol. CLXVIII, No. 10, March 6, 1913.

Roger states that of the ninety cases of "typhoid spines" reported in literature there have been no deaths. so that our pathology has to be determined by a study of the X-rays. Eleven (11) of the cases had X-rays. He shows the X-rays of the two cases he reports, and concludes that the so-called "typhoid spine" is an osteomyelitis of the vertical bodies which causes lesions similar to the typhoidal bone abscesses of other bones located in the cortex just beneath the periosteum.—*James Warren Sever, Boston.*

The Nature of Arthritis Deformans. By Prof. Axhausen, Berlin. *Berl. klin. Woch.*, Feb. 17, 1913, p. 298.

He reviews the vascular theory of Wollenberg (ischemia or hyperemia of the blood-vessels) and the static theory of Preiser-Walkoff. The former he considers not proved from a pathologic standpoint. The cartilaginous necrosis described by Preiser he regards as the basis of all anatomic and pathologic changes in these joints. Bone necrosis may exist without infection and without sequestrum formation. Cartilaginous necrosis varies, as he has found by experiments, according to the mechanical pressure upon it. The gradual wear and tear leads to a slow but continual disappearance of the joint structures, according to the location and the amount of friction. He regards arthritis deformans as a symptom-complex characterized by more or less cartilaginous necrosis influenced by static conditions.—*Roland Hammond, M. D., Providence, R. I.*

The Pathogenesis and Etiology of Rachitis. By Prof. Max Kassowitz, Vienna. *Deut. Medezin. Woch.*, Jan. 30, 1913, p. 201.

In discussing an article by Ribbert on rachitis the author agrees that the origin of the calcium deficiency in rachitic bones is not in calcium metabolism but in pathological changes in the bone-forming tissues and that these changes are set up by irritating substances in the circulation and soft tissues. He does not believe, however, that the irritating substances arise from digestive disturbances due to improper milk feeding. They are more probably due to improper housing and unsanitary conditions, because rickets is a disease of cities, and occurs most frequently in the winter months when infants and pregnant mothers are confined indoors. He believes that "respiratory poisons" pass through the circulation directly to the bones, causing the rachitic changes there.—*Roland Hammond, M. D., Providence, R. I.*

Experiments, Disconnecting of the Thymus Gland. By Matti. *Mitteilungen a. d. Grenzgeb. der Med. u. Chir.*, Vol. XXIV, p. 665.

The complete excision of the thymus in young dogs showed, besides other changes, a distinctly progressive change of the skeleton consisting in softening and curving of the bones, going hand in hand with a very marked weakness of the muscles, and resulting in a complete cachexia with impossibility of locomotion. Under the microscope a distinct similarity with rachitic changes is noticed, seen by the occurrence of limeless bone tissue in very large extension. This change is caused by resorption of calcified bone and extensive new formation of osteoid tissue. From this morphological similarity of the thymectogen processes in the skeleton with the human rachitis conclusion is *not* made that both processes are of the same nature, but it is emphasized that the change is well characterized and typical.—*C. H. Bucholz, Boston.*

On the Action of Calcium Lacticum in a Case of Ostitis Fibrosa. With Experimental Investigations of the Metabolism. By Jacoby and Schrott. *Mitteil. a. d. Grenzgebieten der Med. u. Chir.* Vol. XXV, p. 383.

The authors report the case of a forty-nine year old woman who has suffered since four years from an ostitis fibrosa in many parts of the skeleton. She had not been able to stand and to walk since a considerable time and had sustained a spontaneous fracture of the right humerus which did not show any tendency to union. The examination of the urine shows a markedly high excretion of lime salts. Since Chiari and Januschke have demonstrated that lime salts, especially calcium lactium, act in diminishing the abnormal permeability of the kidney this drug was given with good result. A distinct formation of callus was seen at the point of the fracture which healed within a short time. The patient learned to stand and to walk again. The abnormal excretion of lime salts with the urine was distinctly reduced. The X-ray picture, however, was unchanged. In addition to the application of calcium lacticum the castration by the X-ray was attempted. But the good result is solely due to the drug because the X-ray was used after a considerable effect had already been noticed.—*C. H. Bucholz, Boston.*

Arthritis Hypertophicans. A Contribution to the Classification of Chronic Articular Diseases. By Eugen Nathan. *Mitteil. a. d. Grenzgebieten der Med. u. Chir.*, Vol. XXV, p. 589.

The idea of this paper is to show that the classification of chronic arthritis, commonly used by German writers, is incorrect and misleading. That classification divides chronc arthritis in chronic progressive polyarticular rheumatism and arthritis deformans. Especially the arthritis deformans is not a uniform clinical or pathological picture, because nearly every chronic arthritis leads to the deforming processes of the joints. After briefly reviewing some of the American authors Jacobsohn adopts the term arthritis hypertrophicans nearly in the same sense as it is used by Goldthwait and others. The following are considered as characteristic features of the arthritis hypertrophicans: Usually there is only one joint affected, rarely several joints, most often large joints. The affection has no marked progressive tendency toward other joints and is mostly seen in men. Palpable proliferations or free bodies are frequent. There is no tendency to bony ankylosis. Trophic disturbances are vacant or at least not distinct. The general health is not or not much affected. The X-ray plates show typical bony proliferations.

Next the etiology is considered. Trauma plays a certain rôle, but not in all cases. The rather common opinion that this form of arthritis is seen only in aged people is incorrect. Most cases of the author were in the age of thirty to forty-five years, most of his elbow cases in the age of eighteen to thirty years. He also states that lately several authors have described hypertrophic arthritis in children or youth as a not very rare affection. Arthritis hypertrophicans is a local and not a general disease, and the old theory based on dyscrasia is incorrect. Also the infectious and nervous origin is not likely to have any probability. He then discusses Wollenberg's vascular and Preiser's mechanical theory and speaks against the former, while the latter seems to be more probable though it is not yet sufficiently proved.

In a second part the joints mostly affected are discussed: Shoulder, elbow, hip, knee, tarsus and the first metatarso-phalangeal joint. The term malum coxæ senile is incorrect, becuse of the frequent occurrence of the hypertrophic arthritis in younger individuals. The hypertrophic interphalangeal joints with the typical Heberden's nodes are not mentioned as belonging to the hypertrophic arthritis.

The hypertrophic type is distinguished from the atrophic type, but here the writer does not use the classification of Ameiican authors in infectious arthritis and atrophic arthritis in a special sense.—*C. H. Bucholz, Boston.*

The Acute Inflammations of Bones and Joints in Infancy. By Th. Gebhardt. *Arch. f. Orth. Mech. u. Unfallchir.*, Vol. XI, p. 357.

Gebhardt reports eight cases from Lange's clinic in Munich which all came under observation a considerable time after the acute stage. Some of them showed scars as signs of perforated abscesses, others had seemingly not had any purulent inflammation. In six cases the hip-joint, in two cases the knee was affected.

In all hip cases a severe or even very extensive destruction of the epiphysis of the femur and partially of the acetabulum was seen. Five cases showed a dislocation due to the destruction. Only in one case a flexion contracture was seen. Treatment consisted in reduction, and correcture of the position.

The knee cases showed a right-angle contracture which was corrected by infraction above the condyles.

The histories of the reported cases, with tracings of the X-ray plates are added.—*C. H. Bucholz.*

IV. BONE AND JOINT TUMOR, BENIGN AND MALIGNANT.

Myositis Ossificans Traumatica. By William E. Stevens, M. D. *Journal, A. M. A.*, Feb. 1, 1913.

A case is reported in which the original injury was received on the calf of the leg at the age of seven, ten months later a discharging sinus formed and later healed. Forty-one years later the original sinus broke down and calcified fibrous tissue was removed from it.—*Edward S. Hatch, New Orleans.*

The Growth, the Death and the Regeneration of Bone. By H. G. Witherill, M. D. *Journal A. M. A.*, March 29, 1913.

This article reports two cases with X-ray photographs, and a good discussion of Macewen's theories in regard to the regeneration of bone, it is worth reading in full.—*Edward S. Hatch, New Orleans.*

V. SCOLIOSIS AND STATIC DISTURBANCES.

The New Heel. By Max Strunsky, M. D. *Journal A. M. A.*, April 12, 1913.

In this paper the writer makes the statement that the most frequent cause of painful feet is inflammation of the anterior arches.

He calls the anterior arches "new heels" and says that if the toes are grasped and forcibly flexed great pain is caused if the patient is suffering from inflammation of the anterior arches.

The treatment advised is rest, arch support, and lowering the heels of the shoes. The reviewer does not feel that the first statement is borne out in practice.—*Edward S. Hatch, New Orleans.*

The Treatment of Gastroptosis by a Wedge-shaped Resection of the Pars Media of the Stomach. By E. Schlesinger. *Mitteil. a. d. Grenzgebieten der Med. u. Chir.*, Vol. XXVII, p. 527.

In severe cases of gastroptosis which are resistant to any medical therapy a good result may be obtained by the resection of the medial part of the stomach. The operation which has been done in eight cases, reported in this paper, is indicated only when marked symptoms are present which are to be explained by the alteration of the stomach and not by the general asthenic symptoms, so often noticeable in such cases. The medial part of the stomach is not only inactive in that type of cases, but also it presses down against the transverse colon and is the main cause of the constipation. If the indication is made correctly a complete elimination of the symptoms may result from the operation.—*C. H. Bucholz, Boston.*

The Cause and the Symptoms of Coxa Valga. By Franke. *Diss. München*, 1912. Abstracted in *Ztschr. f. orth. Chir.*, Bd. XXXI, H. 1–2, p. 343.

Franke reports six cases of coxa valga. The essential symptoms of this deformity are outward rotation of the femur, increased abduction, lessened adduction, and limitation of inward rotation, adduction and flexion. The X-ray, which should be taken with the thigh in extreme inward rotation, establishes the diagnosis.—*A. Bruce Gill, Philadelphia.*

The Prevention of Foot Strain. By Robert B. Osgood. *Boston Med. and Surg. Jour.*, Vol. CLXVIII, No. 11, March 13, 1913.

A study of nurses' feet in relation to foot strain and muscle balance, and also a study of a group of 369 college students (female). The prevention of foot strain lies in early and proper care of the feet by the use of good and properly balanced shoes with or without plates or Thomas heels.—*James Warren Sever, Boston.*

The Structure and Mechanism of the Normal Foot and the Flat-foot. By B. Baisch. *Zeit. für orth. Chir.*, Bd. XXXI, H. 1–2, 1913.

The basis of the author's article is a radiographic study of the normal and abnormal foot with and without weight-bearing. These radiographs were taken with a common base line so that the transparent-paper tracings could be superimposed and the position of the bones with and without weight-bearing studied. The author concludes, first, a study of the normal and abnormal foot as described above makes possible a radiographic diagnosis of flat-foot. Second, in the normal foot with weight-bearing there occurs a drawing together or coaptation of the various tarsal and metatarsal bones thus preserving the normal arch. In flat-foot there is a yielding or separation of these bones. Third, talipes valgus and talipes planus may be distinguished radiographically.—*Geo. I. Bauman, Cleveland, Ohio.*

Static Scoliosis. By Robt. Doerr. *Zeit. für orth. Chir.*, Bd. XXXI, H. 1–2, 1913.

Author recommends the careful investigation into the position of the pelvis and length of the legs in all cases of scoliosis and describes an apparatus to be used for this purpose. He contends that many cases of static curvature are caused by coxa vara or difference in length of the legs and that this can be straightened by a proper lift. He also reports one case of pain in the back and curvature due to flat-foot, the pain and curvature being relieved after use of proper plates.—*George I. Bauman, Cleveland, Ohio.*

Etiology of Congenital Scoliosis. By Franz Kauffmann. *Zeit. für orth. Chir.*, Bd. XXXI, H. 1–2, 1913.

Report of three cases of congenital scoliosis with review of all the different theories regarding the origin of this deformity. Author would class his cases and practically all similar cases as "endogenous," "germinal" or "embryonal." The cause of these variations in the embryo is still a question.—*Geo. I. Bauman, Cleveland, O.*

Köhler's Disease of the Scaphoid. By Franz Wohlauer. *Zeit. für orth. Chir.*, Bd. XXXI, H. 1–2, 1913.

In 1908 Köhler described an apparently new disease of the scaphoid—an alteration in the size and structure of the bone. There is local tenderness, swelling and redness and limp. The trouble disappears under different (or indifferent) forms of treatment. Most authors have contended that it is due to trauma. Although admitting that this may be a factor, Wohlauer thinks that it is due primarily to defect in the mechanism of bone development. Report of three cases.—*Geo. I. Bauman, Cleveland, Ohio.*

Observations upon the Architecture of the Os Calcis. By Hans Reiner. *Zeit. für orth. Chir.*, Bd. XXXI, H. 1–2, 1913.

From a radiographic study of the structure of the os calcis in a number of abnormal cases author finds that the interior as well as the exterior structure accommodates itself to varying pressures and pulls—thus upholding Wolff's law.—*Geo. I. Bauman, Cleveland, O.*

The Relation of Scoliosis to School Seating. By James Warren Sever, M. D. *New York Medical Journal*, Feb. 8 and 15, 1913.

Sever believes that faulty seating at school has much to do with the production of round shoulders and scoliosis, especially of the total type, in school children. To obviate this he believes that the child should not be required to sit at a desk for too long a time, and that there should be frequent periods of exercise.

He gives extensive statistics about scoliosis in school children and reviews exercises used in various places, notably the work of G. H. Pfund in Oakland, California.

He then makes a study of the various forms of desks and chairs in cities of the United States with a population of over 25,000. Illustrations of the different types of desk are shown.

The following conclusions are reached:

All chairs and desks should be adjustable to height. Adjustments in other directions are not necessary. The edge of the desk should be about 1 inch in front of the edge of the chair. The desk top should slope 15 degrees and be wide enough to allow the whole arm rest on it in writing. The chair seat should be flat, or slightly concave to fit the buttocks.

The chair back should be wide with but two outside uprights no higher than the lower part of the shoulder blades, with an adjustable cross bar convex forward and concave from side to side to fit the lumbar curve. From a sanitary point of view, single standard chairs and desks are good, provided the other qualifications are not lacking.

Benches, kitchen chairs, movable chairs and settee chairs are bad. Physical education departments are essential in connection with all school departments. Pupils should have frequent rest and exercise periods. —*Archer O'Reilly, St. Louis, Mo.*

VI. CONGENITAL DEFECTS, INCLUDING CONGENITAL DISLOCATIONS.

Bloodless Treatment of Congenital Dislocation of the Hip. By R. Galeazzi. *Zeit. für orth. Chir.*, Bd. XXXI, H. 1–2, 1913.

Author maintains that the antetorsion of the upper end of the femur is the most important element in congenital dislocation of the hip. After determining the exact amount of this antetorsion he reduces the dislocation by rotating the femur inward the corresponding amount, then slightly flexing and abducting at the same time applying traction and pressure over the great trochanter. The hip is put up in the above-described position. After four months fixation he begins active and passive exercises to overcome the torsion.—*Geo. I. Bauman, Cleveland, Ohio.*

Total Congenital Defect of Ribs. By S. Hodda. *Zeit für orth. Chir.*, Bd. XXXI, H. 1–2, 1913.

From the findings in three cases of defect in the ribs and vertebræ author concludes: First, total defect of one or more ribs would be found more frequently if radiographs of the entire thorax were taken in all cases of lateral curvature. Second, total defect of the ribs is usually associated with other anomalies of the thorax or spine.—*Geo. I. Bauman, Cleveland. Ohio.*

The Combination of "Congenital" Dislocation of the Head of the Radius and Little's Disease. By Bruce Künne. *Zeit. für orth. Chir.*, Bd. XXXI, H. 1–2, 1913.

Author reports two cases of dislocation of the head of the radius in conjunction with Little's disease and raises the question as to whether these are congenital or acquired. He believes that these cases as well as others of similar nature, *e.g.*, dislocation of the hip in Little's disease, are not truly congenital but are due to the spasticity of the muscles and should therefore be termed "spastic dislocation."—*Geo. I. Bauman, Cleveland, O.*

The Technic of Club-foot Dressing. By P. Mohring, *Zeit. für orth. Chir.*, Bd. XXXI, H. 1–2, 1913.

After the usual correction one end of a bandage is held above the knee and the other drawn tightly over the foot so as to hold it in the overcorrected position. Wadding and plaster is then applied.—*Geo. I. Buaman, Cleveland, Ohio.*

Congenital Radio-ulnar Synostosis. By B. Baisch. *Zeit. für orth. Chir.*, Bd. XXXI, H. 1–2, 1913.

Report of a case with radiographs. These and similar deformities may arise either from some anomaly in the fetus itself or in some external influence as the pressure of the uterus. The deformity may consist simply of a synostosis between the radius and ulnar with a normal elbow or it may be combined with a lengthening or dislocation of the head of the radius.—*Geo. I. Bauman, Cleveland, O.*

Some Therapeutic Measures. By V. Chlumsky. *Zeit. für orth. Chir.*, Bd. XXXI, H. 1–2, 1913.

Author describes a device for hammer-toe, another for head extension and another for extension in old cases of congenital dislocation of the hip. He uses the hip extension for six to eight weeks and is able to reduce double dislocations in children up to ten years of age.—*Geo. I. Bauman, Cleveland, O.*

The Treatment of Hammer Toe. By Chlumsky. *Ztschr. f. orth. Chir.*, Bd. XXXI, H. 1–2, p. 64.

Hammer toe is usually a hereditary congenital deformity. It occasions many times great inconvenience and it is very difficult of cure.

Hoffa admitted that he had seldom seen a good result from treatment, but nevertheless recommended the use of sandals with elastic slings to hold the toe down. Thilo employed an insole of sole leather to which the toe was fastened by strips of adhesive plaster. Some surgeons, having obtained no result from these methods, have resected the joint, or divided all the soft parts on the plantar surface of the toe, or have even amputated the toe.

The author thinks that these measures leave much to be desired from an orthopedic point of view, and has devised the following method.

He makes an insole according to Thilo's method. Then on each side of the hammer toe he makes a hole, or slit, and passes through these slits a linen strip which passes over the toe. As the ends of the linen band are drawn tightly together the toe is drawn down upon the insole. The foot and insole are placed in a sandal which has a metal ring above the toes. To this ring are fastened the ends of the linen strip. The patient soon learns to apply this properly. After a few weeks the toe is stretched so that it no longer requires fastening to the insole.—*A. Bruce Gill, Philadelphia.*

Congenital Dislocation of the Knee-joint. By Jung. *Arch. f. Orth. Mech. u. Unfallchir.*, Vol. XI. p. 1.

Jung reports the case of a fourteen months old girl who died from a bronchopneumonia. Thus by chance the very interesting preparation was gained which is illustrated in the article. Of the many interesting points may be mentioned the following: On the preparation a very small patella was found which had not been detected during life neither by palpation nor by the X-ray. The poor development of the patella is explained by the lack of contact with the femur and the reduced or deficient function of the quadriceps.—*C. H. Bucholz.*

Two Unusual Forms of Spina Bifida. By Geo. H. Edington, M. D., F. R. F. P. SG. *Glasgow Medical Journal*, LXXIX, No. 3, March, 1913.

The author reports two unusual cases of Spina Bifida. In the first there was a large mass of fat over the cervical spine. This was fluctuant, and bony or cartilaginous processes could be felt deep in the swelling fairly movable to the right of the middle line. On operation the fat was found attached to the dura, a meningeal lipoma. This fact should be borne in mind, or the dura might be accidentally incised. The bony masses were irregular in shape, but represented the laminæ and spinous processes.

In the second case, there was a large tense swelling on the left buttock, at first taken for a sarcoma of innominate bone. After tapping, a cleft could be made out. The large sack was connected with a smaller one which was the distended subarachnoid space. The cord extended to the level of the third sacral vertebra. The cleft was found to involve the whole of the sacral region and the fourth and fifth lumbar vertebræ. There was considerable scoliosis as a result of marked distortion and malformation of the sacrum and lumbar vertebræ.

The most interesting features were the swelling on the side and the length of the cord.—*Archer O'Reilly, St. Louis, Mo.*

VII. TRAUMATIC LESIONS, FRACTURES AND DISLOCATIONS.

Madelung's Deformity. By F. Trillmich. *Zeit. für orth. Chir.*, Bd. XXXI, H. 1–2, 1913.

Report of one case with review of the various theories regarding the origin of this deformity. Author holds that the deformity may arise from various causes. One must assume that there is always a lessened bone resistance due to rickets, osteomalacia, etc. Under Madelung's deformity should be classed those cases of subluxation of the hand coming on slowly and without evident cause, during or after puberty.—*Geo. I. Bauman, Cleveland, O.*

Hand Lesions Following Injuries of the Upper Extremities. By Herman Bucholz. *Boston Med. and Surg. Jour.*, Vol. CLXVIII, No. 16, April 17, 1913.

An interesting paper showing the bad results after fractures from too long fixation in splints, due to atrophy of bone and soft parts. The author believes that we should leave on splints a shorter time than we do now, and that we should direct our treatment toward a functional cure from the very beginning.—*James Warren Sever, Boston.*

Operative Fixation as a Cause of Delay in Union of Fractures. By John B. Roberts, Philadelphia. *Annals of Surgery*, Vol. LVII, No. 4, April, 1913.

The author reports a case of delayed union of the tibia following the application of a Lane bone plate and reviews some of the recent literature in regard to the operative treatment of closed fractures. He shows that union is usually delayed by the presence of a bone plate, and that there is the usual danger of sepsis. He believes with others that bone plating is being carried to too great an excess and that perhaps the surgical world is about ready for a reaction from its excessive use. A thoughtful and suggestive paper for those who would bone-plate every fracture.—*James Warren Sever, Boston.*

Joint Ankylosis, Its Prevention and Treatment. By Wahl. *Münch. med. Wochenschr.*, 1912, No. 45.

Ankylosis is usually due to an acute or a chronic joint inflammation or to fractures involving the joint.

A joint should not be immobilized too long after an acute suppuration of the joint and in rheumatic or gonorrheal arthritis.

In tuberculosis Bier's hyperemia is valuable in restoring function of the joint.

Medical gymnastics, massage, and baths are to be employed in mobilizing joints, while open operations are necessary in certain cases.

Wahl employs fixation with extension in fractures involving the joints, and has devised splints for this purpose. Early massage and movements are essential in treating all injuries of the joints.—*A. Bruce Gill, Philadelphia.*

The Treatment of Internal Derangements of the Knee-joint. By Oscar Vulpins. *Münch. med. Wochenschr.*, March 4, 1913, p. 453.

The former diagnosis of internal derangement is now replaced by a more exact and definite terminology. We now distinguish avulsion of the crucial ligaments, and avulsion of the ligaments with fracture of the bone at the point of their insertion; and we recognize various forms of injury of the semilunar cartilages. There remains, however, some differences of opinion among surgeons concerning the point at which injury of the cartilages usually occurs. The author believes that a tear in the cartilage occurs more frequently at the point of its greatest convexity than at its anterior or posterior points of attachment.

The following general rules should guide the treatment of injury to the cartilages: Immediately after the injury the cartilage should be replaced by manipulation, if dislocated. The knee should then be kept at rest for five or six weeks. Good results have followed this treatment alone in many cases. Some cases, however, are not so fortunate; there is pain, pinching of the cartilage, and effusion into the joint. Open operation is then necessary, either to repair the injury to the cartilage and fasten it in place, or to extirpate it. In certain cases of loosening of the cartilage he attempts to fasten it in place by inflammatory adhesions produced by the injection of a few drops of alcohol at the proper point or by inflating the joint with oxygen.—*A. Bruce Gill, Philadelphia.*

Treatment of Fractures. By J. C. Landenberger, M. D. *Northwest Medicine*, Vol. V, No. 3, March, 1913.

Landenberger believes that all fractures should be reduced under an anesthetic and that sufficient time should be taken to secure a proper reduction. Results should be confirmed frequently by the X-ray, and dressings should not be removed too often. The most satisfactory splint for fractures of the long bones is plaster of Paris, but this should be applied only by an expert. When splinting does not hold the fragments in position, traction is very useful. Immobilization should be maintained only until bony union has taken place. This should then be followed by active and passive motion and massage. The end to be sought is good function with the minimum amount of deformity. This can usually be obtained without operation, especially if strong traction is used in difficult cases. When this is possible, open operation is not advisable.

Landenberger then quotes from various surgeons who have operated extensively on fractures statistics from which he draws the following conclusions:

"From these statistics conservative indications for operative interference would be (1) when a good functional result cannot be obtained; and (2) when obvious deformity cannot otherwise be corrected."

"As a closing remark, I wish to emphasize the importance and efficiency of weight and extension which, if properly and widely used, would surely reduce the frequency of the necessity for open operation.—*Archer O'Reilly, St. Louis, Mo.*

Ununited Fracture Treated Twice Unsuccessfully by the Lane Plate Method and Successfully by Insertion of a Tibial Bone Plate. By Thos. W. Huntington, M. D. *Northwest Medicine*, Vol. V, No. 3, March, 1913.

Huntington reports a case of fracture of the femur in which nonunion persisted after two attempts at Lane plating. The fragments were in excellent apposition. After both attempts the plates had to be removed on account of sinuses developing several weeks after operation. Finally a wedge was removed from the opposite tibia and implanted. This operation was followed by union of the fragments.—*Archer O'Reilly, St. Louis, Mo.*

Some Points of Interest Regarding Long-bone Fractures. By A. Aldridge Matthews, M. D. *Northwest Medicine*, Vol. V, No. 3, March, 1913.

The author believes that we are going to use plates more and more. The public demand an exact anatomic reduction of the fracture. This can best be obtained by the use of plates. The operation, however, is difficult and to be successful requires considerable skill. The technic and asefsis must be faultless. At present, the most serious objection to the general use of plating is the danger of infection.

The author believes that the most useful form of plates is either silver or venadium steel.

Seven cases are reported with radiographs.—*Archer O'Reilly, St. Louis, Mo.*

The Immediate Treatment of Fractures. By W. W. Grant, M. D. *Colorado Medicine*, Vol. X, No. 4.

By this is meant not only the emergency treatment but also that of a more permanent character. When severe shock is present the patient should be handled or moved as little as possible until this passes away. Our enthusiasm may lead us into a too extensive use of plating. It should be used, however, in certain cases, especially fractures of the long bones, where good apposition cannot be obtained. This is the case in open or closed fractures. Plating in an open fracture is frequently accompanied by infection which necessitates the removal of the plates. Probably the clamp and screw of Parkhill would be more satisfactory and lessen the danger of infection.

In seven fractures of tibia and fibula near ankle joint good results can only be obtained by plating, by staple or with screws and clamp.—*Archer O'Reilly, St. Louis, Mo.*

Fractures Into and About the Joints. By Charles E. Caldwell. *Lancet Clinic*, Vol. CIX, No. 11, March, 1913.

The author rather fully describes the various fractures about and into the shoulder, elbow, hip, knee and ankle joints. The treatment is given in considerable detail. The author seems to be of the opinion that operative interference should be indulged in only where conservative methods are inavailing. If operation is necessary for proper reduction it should be done at once. The paper is profusely illustrated with tracings.—*Archer O'Reilly, St. Louis, Mo.*

VIII. APPARATUS AND X-RAY.

A New Artronimeter. By R. Galeazzi. *Zeit. für orth. Chir.*, Bd. XXXI, H. 1–2, 1913.

A very simple and ingenious instrument for measuring angles of deformity. See illustration.—*Geo. I. Bauman, Cleveland, O.*

IX. MISCELLANEOUS DISEASES. GENERAL ORTHOPEDIC ARTICLES. PHYSICAL THERAPY.

Transplantation of a Phalanx of a Toe to Replace a Phalanx of a Finger. By W. Goebel. *Münch. med. Wochenschr.*, Feb. 18, 1913, p. 356.

Goebel reports the following case: A boy sixteen years old had a tumor of the proximal and middle phalanges of the fourth finger of the left hand. It had been present since his sixth year and had reached the size of a pigeon's egg. It severely disabled him in his work as his finger was pushed outward and could not be flexed. The X-ray established the diagnosis of enchondroma of the proximal and middle phalanges, and showed also a beginning enchondroma of the distal phalanx. Evidently, the preservation of the finger was impossible, but neither the youth nor his father would permit its amputation. Therefore, the proximal phalanx of the finger was removed and the proximal phalanx of the second toe was put in its place. The capsular ligaments were united with fine catgut and the fascia and skin closed over the bone. The defect in the toe was filled with a piece of cartilage taken from the sixth rib.

The wound healed without any trouble. The day after the operation careful movements of the left hand were begun. Ten days later the finger could be actively moved as freely as before the operation; although the condition of the second phalanx prevented full motion of the finger. At the end of five weeks the enchondromata of the middle and distal phalanges were removed with a sharp curette. After this operation fuller motion was possible. The patient returned to work in the ninth week, without suffering from any pain or disability. The implanted phalanx underwent no atrophy and full motion in all joints was finally established. The cartilage healed into the toe; but the X-ray does not show that it has as yet been transformed into bone.—*A. Bruce Gill, Philadelphia.*

Acute Traumatic Subdeltoid Bursitis. By Joseph M. Flint, M. D., *Journal A. M. A.*, April, 19, 1913.

The author reports two cases of acute subdeltoid bursitis in which he aspirated the bursa with such marked relief, that he recommends that treatment for this condition.—*Edward S. Hatch, New Orleans.*

Restoring Mobility after Bony Ankylosis of the Joints.. By Tunstall Taylor, *Penna. Med. Jour.*, Jan., 1913.

Various methods, extending over many years, have been employed to secure mobility in ankylosed joints. Brisement forcé and the interposition of foreign nonabsorbable substances are now obsolete. The interposition of flaps of muscle or fascia with a nutritive pedicle or the interposition of heterogenous fascia or membrane are only partially successful owing to subsequent pain, fever, suppuration, sloughing, sinus formation and reformation of adhesions in certain cases. The use of autogenous or homogeneous fascia without nutritive pedicle, and the use of absorbable animal substances are still *sub judice*.

The author has experimented to determine a liquid, absorbable animal substance that could be injected between the ends of the bones and within the capsule of the new-made joint and that would harden there and prevent contact of the bones for six or eight weeks before it should be absorbed. He finally settled upon yellow wax, one part, and lanolin, two to six parts, having, when mixed, a melting point of 120° to 135° F. He now reports ten cases in which he has employed this method in human patients with very satisfactory results.

Taylor claims for his method the advantages of the prevention of the reformation of bony adhesions, the absence of pain, fever, and suppuration, the early, voluntary ability to move the joint, and the rapidity with which the operation can be done.

Arthroplasty should never be employed in the presence of active disease.

The new joint should be fashioned as far as possible like the normal joint without injury of the soft parts about it. An excessive amount of wax should not be used, but only enough to cover the ends of the bones and keep them from contact with each other. Extension may be employed after operation on the lower extremity.—*A. Bruce Gill, Philadelphia.*

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XIV.

RADIOGRAPHY OF THE VERTEBRAL COLUMN IN PROFILE IN POTT'S DISEASE.*

BY DR. JACQUES CALVÈ (BERCK-PLAGE, FRANCE) AND DR. HENRI LELIÉVRE (SÉES, FRANCE).

In addition to the radiograph taken in front, with the patient lying on the back, we have used for two years at the Maritime Hospital and in our private practice the radiograph taken in profile of all our patients with Pott's disease. We should like here to show everything of interest, as much from the clinical point of view as from the therapeutic and prognostic. Thanks to these radiographs, indeed, one can track out a lesion from the very beginning, follow it in its evolution, determine exactly the most useful orthopedic attitude, and finally know when definite cure is obtained.

I. *Diagnosis of Incipient Pott's Disease.*—The diagnosis of Pott's disease is, in the great majority of cases, established too late. The kyphos is the indication of a lesion already advanced. Between the onset of Pott's disease and its first clinical manifestations there exists a long phase of latency, during which the lesions, under the influence of weight and muscular contraction, become aggravated. It is, then, in the interest of the patient to establish an early diagnosis.

It is true that, as in coxalgia, the symptomatology in the beginning is baffling. Before the kyphos, before even the generalized contracture of the vertebral column (revealed by the classic test of making the patient pick up an object without bending the knees) a careful examination would reveal, or at least permit one to suspect, a vertebral osteitis.

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* This is the first in a series of four articles to appear in this Journal in 1913–14 by our French colleagues.

With some, a scarcely evident contracture, localized in a segment of the spine, partial in character, does not prevent the patient from stooping to pick up an object; a slight difficulty in gait, an exaggeration of the reflexes with others, or a bilateral sciatica, etc., are the signs which ought to draw attention to the spine, but they are not presumptive signs. The radiograph taken in profile in such cases carries weight and certainty. One finds constantly if Pott's disease exists a very clearly marked thinning of an intervertebral disc. Fig. 1

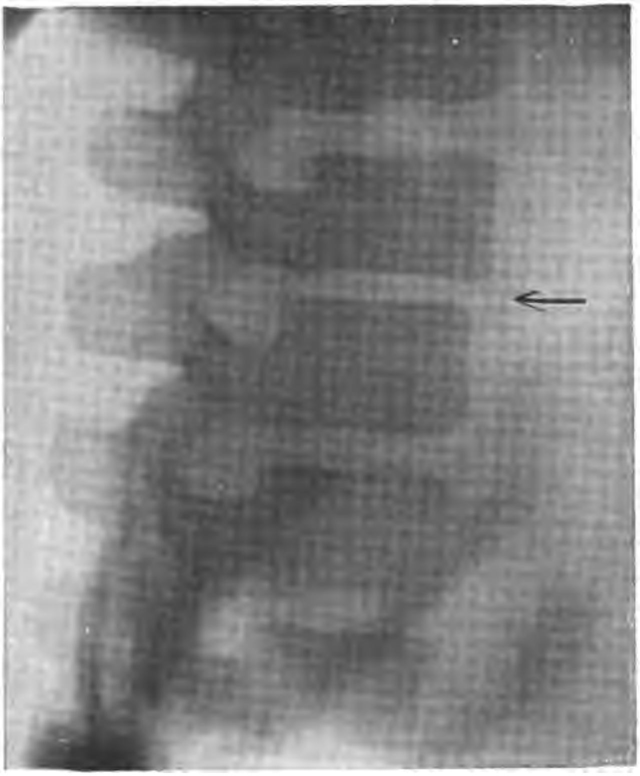

Fig. 1.—Radiograph of beginning Pott's disease. Thinning of an intervertebral disc.

is the radiograph of a child in whom, from the clinical point of view, there was no other sign than a slight limitation of extension of the lumbar spine, flexion being made normally. The diagnosis of vertebral tuberculosis made after the radiograph was taken, which indicated a thinning of the intervertebral disc situated between the third and fourth lumbar, was confirmed by a radiograph taken twelve months afterward, in which the osseous destruction was manifest (Fig. 2).

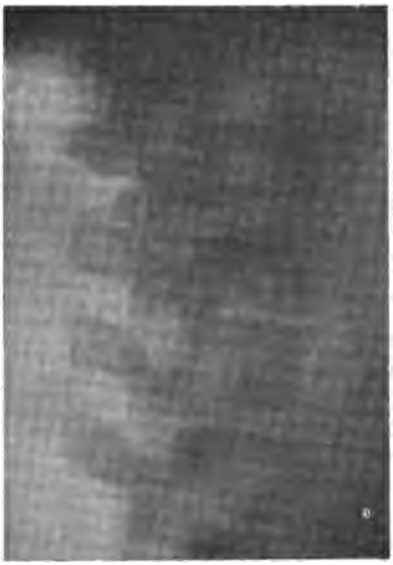

FIG. 2.—Radiograph of the same patient a year afterward. The disc is entirely destroyed. The vertebra underneath is in part destroyed and encloses a sequestrum.

II. *Study of the Kyphos.*—The profile radiograph permits one to follow step by step the formation of a kyphos. When the osseous destruction is sufficient, the vertebral column breaks (a true pathological fracture); the two fragments are held behind by the ligaments and muscles which unite the laminæ and the spinous apophyses, and especially by the capsule and the ligaments of the posterior vertebral articulations. These various means of union, especially in the beginning, oppose themselves to all displacement *en masse* of the fragments either in front or behind, but by their very physiologic function they do not oppose themselves to either a tipping movement forward or to a settling movement behind. It may be interesting to refer here in a few words to a point of normal physiology, on which one of us has for a long time insisted in his thesis,(1) and which aids in understanding certain peculiarities of mechanism by which the kyphos is produced and also permits one to draw some interesting deductions from a therapeutic point of view.

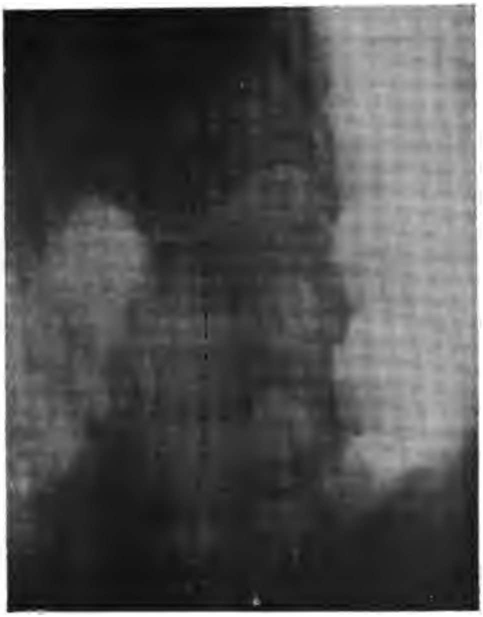

FIG. 3.—Radiograph of a vertebral column (lumbar region) in extreme flexion. The dotted line shows the "neutral line."

When the normal vertebral column is placed in extreme flexion (Fig. 3) various modifications are produced, which the radiograph in profile shows perfectly.

1. The intervertebral discs are settled in their anterior portion in consequence of the pressing together of the vertebræ.

2. The spinous apophyses are separated from each other noticeably.

This double movement has its principle seat in the posterior vertebral articulations where the surfaces slip over each other and up and down. They are not then, as has been wrongly said, a pivot around which is made a tipping movement. Where, then, is the axis of this movement? It is sufficient to examine closely Fig. 3 to determine the situation. The intervertebral disc, diminished in height, pinched in front, is increased in height and widened in the posterior portion. It is easy to deduce that in a portion which it remains to determine in this motion of extreme flexion, it is neither compressed nor distended, forming thus the center of this slipping movement of the articular apophyses, one over the other.

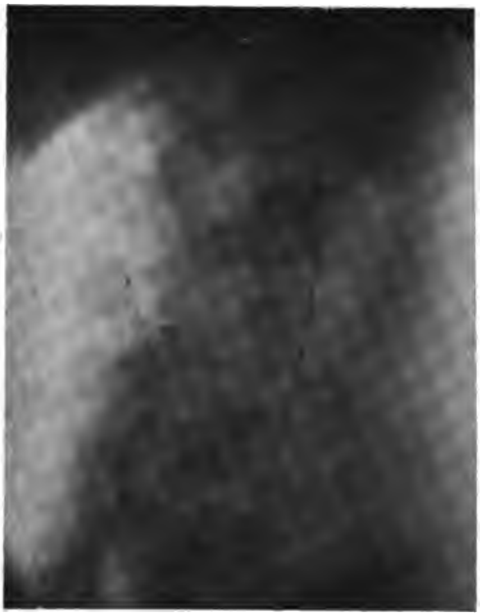

Fig. 4.—Vertebral column (lumbar region) in forced lordosis. Neutral line dotted.

If this question arises in the case of a vertebral column placed in hyperextension, in forced lordosis (Fig. 4), it is equally easy to determine that the same region of the intervertebral disc is no more compressed than distended, as well in extreme extension as in extreme flexion, and if after having determined the neutral point of each intervertebral disc, each of these points is joined by a fictitious line, called by one of us the neutral line, there is a true geometric figure made of all the points of the vertebral column which sustain in the principle movements of the spine the minimum of pressure.

What are the deductions which may be drawn from this neutral line in Pott's disease from a pathological point of view?

The work of Lannelongue has made known the very considerable rôle which is played by the pressure, one against the other, of two osseous surfaces impaired by tuberculosis from the point of view of their reciprocal destruction. He has called it "compressive ulceration." When, in consequence of the destruction of the intervertebral disc, and under the action of the weight and muscular contraction, the superior fragment is inclined forward, it is capable of exercising considerable pressure on the inferior fragment. According to what we have said above, this pressure will be exerted only in front of the neutral line, and it is only in this portion that destruction will take place. Each of the vertebræ in contact will be worn out progressively, but unequally, in such a way that they take on a cuneiform appearance (Fig. 5).

The height of the anterior border of the impaired vertebræ gradually lessens, until complete disappearance takes place. This wearing process has as its direct consequence the increase of the flexion and consequently of the kyphos. Localized in the anterior portion of the vertebræ, it contrasts with the integrity of the posterior portion situated behind the neutral line; the posterior border retains almost completely its normal height; if one does not intervene with appropriate treatment the same causes are always operative; the pressure of the superior fragment continues to be exerted on the anterior portion of the inferior fragment. It decapitates, so to speak, the last vertebra of this fragment, penetrates the underlying vertebra (see Fig. 6), progressively wears out the anterior portion of this one, and as the flexion reaches almost a right angle, becomes perpendicular to the axis of the inferior fragment.

At this phase of the destruction, an aggravation of the kyphos is produced by the following mechanism:

The superior fragment no longer being held in front, becomes more bent, and by means of an actual slipping its anterior aspect comes into contact with the superior aspect of the inferior fragment (Fig. 7), occasioning thus an extreme inflexion and a considerable kyphos.

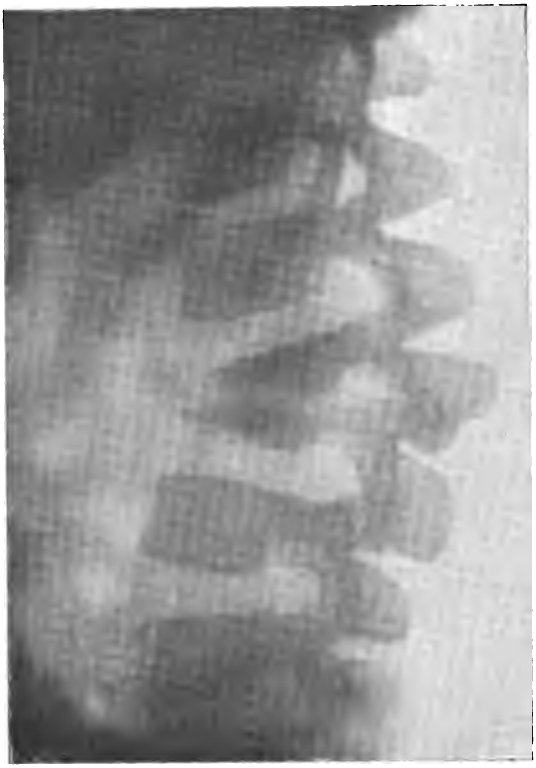

FIG. 5.—Pott's disease where the initial symptoms go back more than two years. Shows cuneiform disposition of focus, absence of consolidation and of osseous neo-formation. A compensatory lordosis is beginning to form under the focus.

III. *Study of the Treatment.*—Is it possible to combat such a deformity? Can one prevent it, or if it exists, can it be corrected?

We have described in another place(2) the treatment of Pott's disease, and we shall insist here on certain points which the radiograph in profile permits one to state precisely, and on which it gives information of considerable practical importance.

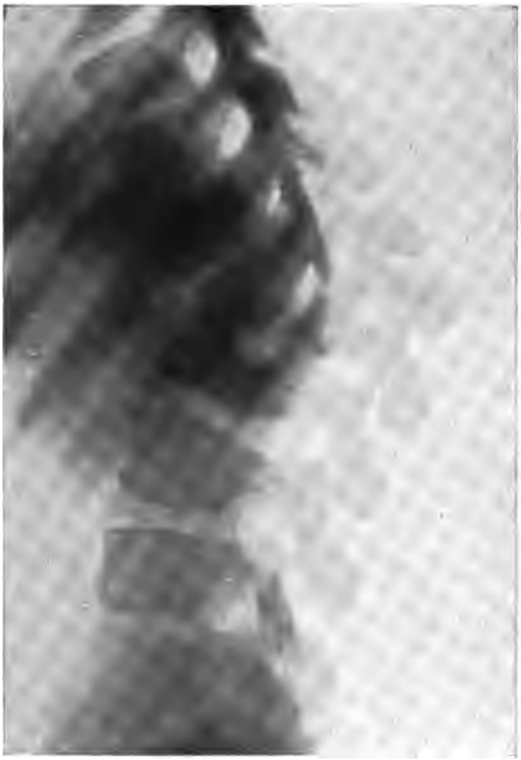

FIG. 6.—Pott's disease insufficiently treated. Shows that the superior fragment has decapitated the first vertebra of the inferior fragment and penetrated into the anterior part of the underlying vertebra.

1. Before the kyphos.

That which has been said before concerning the neutral line, and which shows so clearly, the examination of Figs. 3 and 4 explains sufficiently without making it necessary to insist further on the need of putting the affected portion of the spine in lordosis in such a way as to prevent the anterior wear and tear, annulling the effect of the compression phenomena in front of the neutral line.

2. When the kyphos exists the problem is double:

(a) It is necessary to prevent aggravation of the difficulty. It is evident that for the same reasons the lordosis is sufficient to accomplish this purpose.

(b) It is necessary to correct it. Mr. Ménard in his treatise(3), "A Clinical Study of Pott's Disease," based on the examination of numerous anatomic specimens, has established certain fundamental rules which have been often disregarded. The radiograph in profile precisely confirms these.

Pushing the comparison of Pott's disease with traumatic fracture to an absurd length, it has been said, and is still said, that to correct a kyphos it is sufficient to replace the two fragments, separating them from each other in front, either by a forcible replacement under anesthesia or by a slow, progressive redressment; between the two fragments thus separated there would be established osseous bands of neo-formation, a callus, an outline of a definite solid ossification.

Nothing is more simple to conceive; in reality nothing is more false. A long time ago Mr. Ménard affirmed that osseous tissue affected by tuberculosis is never restored from the bone. He asserted that if the two fragments are separated and maintained in that position by methods of reduction (corsets, plaster, etc.) that when these supports were taken away the two fragments would again come in contact and the kyphos form again. Certain clinical facts seem to demonstrate this: the radiograph in profile proves it decisively.

In none of the cases here cited there can be seen a trace of osseous neo-formation or hyperostosis (Figs. 5, 6, 8). We have followed in the Maritime Hospital some cases in which we have provoked a separation of the fragments, and notwithstanding the lapse of a considerable length of time (several months), there is not even the outline of the formation of an intermediary callus. One has the impression that if the vertebral column were not retained in plaster of Paris that the angle of inflexion would be produced again immediately. We will publish a report later.

It is not, then, the opening of the focus that is in question; it is in provoking the settling down of the focus itself on one side and of compensating lordoses above and below this focus, so that one will bring to pass as soon as one sees the radiograph in profile the correction, or at least the compensation, of a recent kyphos.

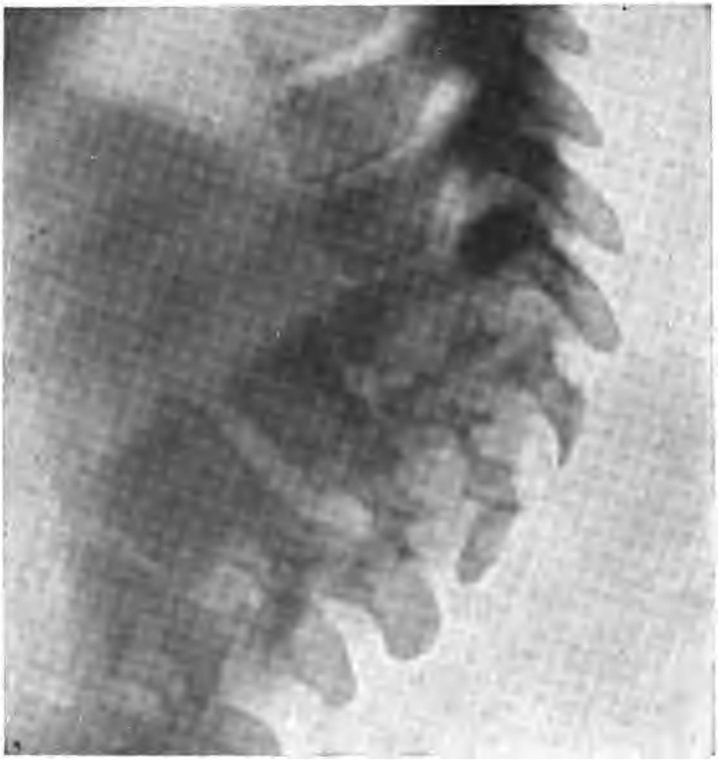

FIG. 7.—Untreated Pott's disease. Kyphos considerable through slipping of the inferior fragment in front of the superior fragment. Three vertebræ are destroyed.

(a) Posterior settling down. In posterior settling down it is necessary to understand the bringing together on a level with the kyphos of the spinous apophyses, without the two fragments being separated, nevertheless, in front. The affected vertebræ in their posterior portions, remaining high, oppose each other. If one provokes a progressive lordosis one relieves, as we have already seen, the anterior portion, and moreover, according to the disposition of the neutral line, one establishes a strong pressure of the posterior portions of the vertebra one on the other, and therefore by compressive ulceration, diminution in height of the vertebral bodies in their posterior portion and possibility of bringing the spinous apophyses together; the vertebræ, on account of destruction, change their shape; from cuneiform they become rectangular, the diminution in height having a tendency to equalize them in front as well as behind. It produces a slipping up and down of the posterior articular surfaces on each other; the superior fragment tips backward, and consequently the kyphos diminishes; moreover, the hyperextension prevents the slipping of the superior fragment as we have seen produced above. Therefore, in equal numerical destruction (three vertebræ), but thanks to a more extensive distribution of this destruction, the attitude is better and the kyphos less (compare Fig. 7 with Fig. 8).

(b) Compensatory lordoses. We will not describe here the way to obtain these (see loc. cit.); we will only call attention to the fact that these will be more efficacious as they are developed as near as possible to the focus, immediately above and below.

Radiograph Fig. 9 shows the mechanism of their formation; separation of the vertebral bodies in front by distention of the intervertebral discs; slumping of the same vertebral bodies behind by the settling down of the discs; slumping of the pedicles and the spinous apophyses; close contact throughout their whole extent of the posterior articular vertebral surfaces.

IV. *Study of the Prognosis.*—(a) Extent of the focus. The radiograph in profile permits one to count the number of vertebræ affected or destroyed. It determines exactly the limits of the focus, and shows from an orthopedic point of view that the gravity of a Pott's disease is not only measured by the function of the number of vertebræ destroyed (see Fig. 7 and Fig. 8), but depends also upon the treatment applied.

(b) Duration of Pott's disease. Here too, thanks to the radiograph in profile, is confirmed a fact which Mr. Ménard has had the great merit of pointing out, the importance of which is considerable. That a focus of Pott's disease does not show a trace of cicatrization before two or three years; this only begins to take place after the third, and is often only complete after five or six years, and even more.

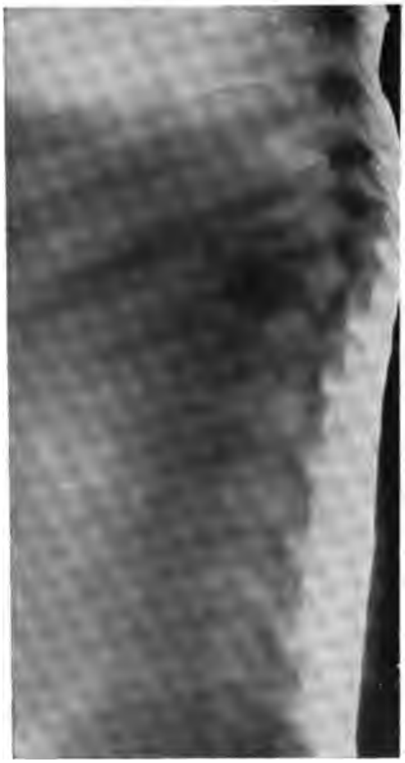

FIG. 8.—Pott's disease rationally treated. Three vertebræ destroyed. The vertebral column is in good position. cf. Fig. 7. Shows compensatory increase of vertebræ lying under focus; corrective incurvation of spinous apophyses and atrophy of pedicles on a level with the focus.

V. *Study of the Cure.*—Fig. 9 shows a vertebra with two pedicles, an osseous block resulting in reality from the fusion of the osseous portions remaining healthy. The consolidation is osseous, without there having been, we repeat, neo-formation. After the fibrous union, which is the first stage of cicatrization, there succeeds osseous consolidation, the last stage of repair.

The radiograph in profile shows in relief the other processes of cure, of which the result, from the orthopedic point of view, is to diminish or to compensate the deformities definitely acquired.

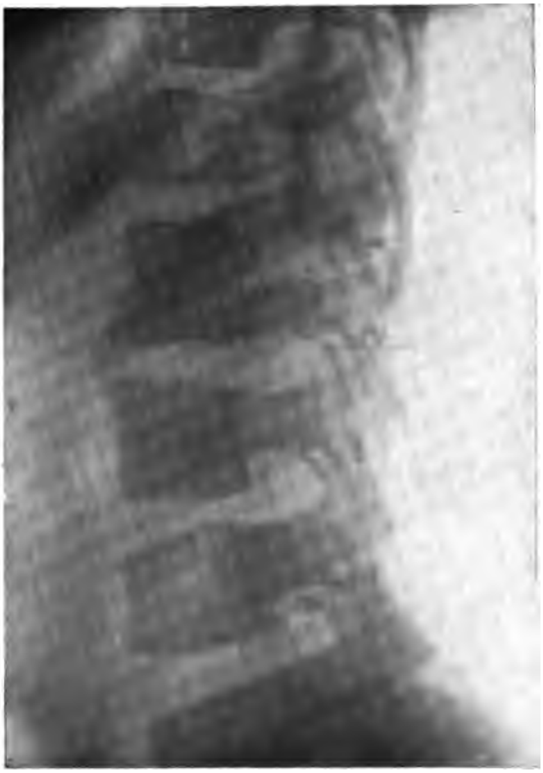

FIG. 9.—Pott's disease treated and cured. Two vertebræ consolidated. Shows posterior settling down and equal distribution of the osseous destruction. Shows compensatory curves and mechanism of cure; osseous consolidation without neo-formation.

1. An atrophy and incurvation of the spinous apophyses (see Fig. 8), having the effect of diminishing the protrusion of the kyphos.

2. An atrophy of the pedicles (see Fig. 9), permitting a very efficacious posterior settling down.

3. An increase in the height of the vertebræ lying above and below the focus (see Fig. 7), compensating thus in part for the diminution in size caused by the vertebral destruction.

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XV.

EXPERIENCE WITH FOERSTER'S OPERATION.*

BY S. J. HUNKIN.

(From the Orthopedic Department of the University of California.)

It is the purpose of the following report, on the one hand, to add to the data available on the treatment of spastic paralyses by section of the posterior nerve roots, on the other to give some details of surgical procedure as applied to these cases. Our experience may be summarized as follows:

In all we have had eighteen operations on fifteen patients. In four cases, however, the records are missing and the patients cannot be located. These four left the hospital in good condition, and while they cannot be used in this paper for result comparison with other procedures, they can be used in considering the mortality rate. In the fourteen patients whose records are available, three operations were made in the cervical region and eleven in the dorsolumbar region. Of the cervical operations one was made for spasmodic torticollis with no subsequent return of spasm, although the patient still complains of pain low in the occiput and in the hands. The other two cervical operations were made in bad cases of Little's disease. The parents are pleased with the result and we see improvement, but of our entire series these show the least gain. Of the dorsolumbar operations one was performed in a man with progressive spinal spastic paraplegia of questionable etiology, with a brilliant result. The remaining ten were made in children with Little's disease. The cases which are missing from this report were all Little's disease cases in whom the dorsolumbar operation was made.

In our entire series there were two deaths—one in a case of hydrocephalus with spastic paraplegia, in which the child collapsed shortly after leaving the table, apparently from extreme loss of cerebrospinal fluid; the other in a child with Little's disease—in whom the dorsolumbar operation was made. In the second case death occurred a couple of hours after the operation for reasons which could not be clearly determined. All the others recovered without particular shock or untoward symptoms. Cessation of spasm occurred in all our cases immediately after the operation and in none did it recur to any extent. All reflexes were abolished after the operation for twenty-four to seventy-two hours, and then approximated the normal type. In the children, of course, the exact time of return of sensation was questionable. In three adults sensation remained absolutely abolished for two days in two cases, and for three days in one, and then returned gradually to about normal. With one exception, sensation in the entire series is at present, as nearly as can be determined, normal. The exception (an adult) has normal sensation in his legs, but has an anesthetic band about the hips.

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* Read before the American Orthopedic Association, May, 1913.

The end-results may be summarized as follows: All our cases are improved, most of them greatly improved, so far as spasm and general muscular control are concerned. There has never been return of spasm in adductors. The only spasm which either remained or recurred was in the knee flexors, and when of any especial degree was readily controlled with a simple splint. Those improved most are those which received care at home shortly after the operation and consequently received better individual training in voluntary movement, treatment which it has been difficult for me to obtain in satisfactory manner in the hospital. The greatest individual improvement occurred (with the possible exception of an hemiplegia case) in the man who has been spoken of as having an anesthetic band around the body. His detailed history is of interest.

W. A. E. is an intelligent college student, twenty-two years old, with a negative family history. He was a rugged boy until thirteen, when he suddenly lost consciousness after long play in a temperature of 115° F. He recovered consciousness next day when it was found that he had internal strabismus of the left eye, and that both legs and arms were weak. He had fever for three weeks. While convalescent he developed pneumonia, which again put him to bed for five weeks. When again convalescent he used a cane for six months, which I regard as evidence that he must have had weakness in his legs. His left eye was not normal until the end of this period. For the following three years he did all that other boys did without difficulty. When about nineteen, it was noted that his feet were swollen and did not act well. His condition would improve during warm weather to get worse in winter. Sometimes the right side would be the more affected, at other times the left. Steadily, however, he has gotten worse, so that during the last summer he noted no improvement. November 20, 1912, when first seen he had an extremely spastic gait, and could only go a few feet with the greatest difficulty, aided with crutches. During the time which elapsed between the first examination and the day of operation (December 5, 1912) he lost so much that he could not walk, even with crutches.

Examination showed the eyes to be normal in motion, reaction, and field; the cranial nerves were normal; the reflexes in the arms were lively; in the lower limbs all reflexes were greatly exaggerated, with marked clonus in the knees and ankles; Babinski and Oppenheim signs present; from below the armpits the sensations of touch, pain, heat and cold, and muscular sense were all markedly changed. Delay in recognition and tendency toward anesthesia increased from above downward. The Wassermann reaction in blood and cerebrospinal fluid was negative.

Operation as outlined in the clinical table was performed December 5.

On March 10 his condition was as follows: The patient walks up and down stairs unassisted; he walks a mile and a half daily using only a cane, and walks a fifth of a mile without any artificial assistance. His gait is rather deliberate, and he walks more slowly than the ordinary person, in other words he has virtually no spasticity. For the last month (March–April) he was been in the Rocky Mountains, and in spite of the great cold his gait is steadily improving. Quite as satisfactory as his change in physical state is his change in mind. From great depression he turned to a more cheerful outlook upon life.

Clinical abstracts of my fourteen cases are given in the accompanying appendix.

My own method of accomplishing the end sought and suggested by Dana and Foerster is as follows: It differs, I believe, from that followed by other surgeons, and has, I think, some advantages. The following special articles are necessary.

1. A regular carpenter's butt chisel 1 1/2 to 2 inches wide with short shank and handle.

2. A stone-cutter's mallet.

3. Strabismus hooks, with bulbous ends made smaller and very smooth.

4. Broad (2 3/4 inch) and moderately deep claw retractors.

5. Gauze sponges rolled cigarette wise, of proper length for the necessary incision, and of requisite fatness.

6. A weak solution of adrenalin.

I omit discussion of surgical preparation of the patient. He is placed on his abdomen, either flat or slightly pillowed into posterior convexity. A longitudinal incision through the skin over the spinous processes is made. The broad butt chisel is then brought into play, and with a few forcible strokes and a little leverage the fibrous tissue, muscles, and most of the periosteum are separated from the spines and laminæ. The broad blade of the chisel controls most of the hemorrhage. The space is then packed with the cigarette sponges which have been lightly wrung out in the adrenalin solution. The other side is attacked in a similar manner and similarly treated. The whole process is then repeated so as to be sure the bones are completely bared. We wait a full minute, with the sponges held tightly in place, and then with the retractors separate the muscles, the cigarette sponges being retained between the muscles and the retractors. A few snips with the scissors may be necessary for some small tendinous strips which remain attached around the base or between the spinous processes. Sometimes it is necessary to use two or three hemostats, applied directly to or close to the bleeding bone, or to the muscles. A chisel is next inserted under the lowest spinous process near its base, and with a single tap for each vertebra with the heel of the hand in a child, or with the stone-cutter's mallet in an adult, the spinous processes are cut through. They are held to each other by their ligaments in a single strip which is wrapped in a piece of salt water gauze and, still attached to the uppermost spine, is turned up on the skin. All bleeding is now controlled either by pressure or by hemostat and ligature. It takes four to six minutes depending upon whether it is necessary to use many hemostats and ligatures or not, to reach this point in the operation. The lowest lamina, or what is often more feasible, the lamina next above, is divided either with a Horsley forceps or with a Hoffmann cranial cutting forceps with unusually long blades. After these laminæ have been removed the work is better completed with the Hoffmann forceps. Both the right and left laminæ are removed; that is the posterior arch is completely taken away, it having been impossible for me in the single instance in which it was attempted, to see the roots on the opposite side when the laminæ were removed on one side only. The bony walls are smoothed with a rongeur, and again the bleeding is carefully considered. The dura is opened between two small tissue forceps and slit the full length with scissors, the edges being held here and there with small hemostats. The posterior roots are found in the usual manner and isolated with the blunt hook, and a piece approximating 1 cm. is resected, care being taken to find and avoid cutting a small vein which usually accompanies the nerve root. This vessel seems to be larger on the twelfth dorsal or on the first lumbar roots than on any of the other roots, although it does not so appear in the anatomical works consulted. These vessels when divided bleed enough to greatly obscure the field and interfere with the progress of the operation.

In my own cases I have usually divided two adjacent roots, skipped the third, cut another two, etc. In the several cervical cases three roots were divided in succession before a skip. The return of sensation in these cases was the same as in the others.

The dura is closed with very fine catgut, the wound itself with heavy chromic catgut armed with a heavy full-curved needle. The sutures are passed through the fascia and the muscles, then through the ligament holding the spines together, then through the muscles and fascia on the opposite side. Close suturing is desirable, thus securing the spines in their proper location and in direct contact with the periosteum of the removed laminæ and the spinal bases. The posterior arch is practically restored at once, with either bone, fragments of bone, or periosteum. The skin is sutured with silkworm gut. Generally no drain is used, although when oozing cannot be entirely stopped a silkworm-gut drain may be used for two days. In two instances where some bleeding persisted from the meningorachidian plexus (and in both instances this was on the left side) a small gauze strip was packed against the point, and the end left out of the wound. One of these instances occurred in the child which died of respiratory failure. In the other instance the gauze was removed safely on the fourth day. In the dorsolumbar cases a plaster jacket was applied over the usual surgical dressing with the column in moderate hyperextension. In the cervical cases head traction was used, with the neck in moderate hyperextension over a moulded pillow.

From our experience we may then say that the results have been fairly good. They have not been as good as I had been led to expect, but it remains true that all my patients averaged greater improvement than I formerly attained with other procedures.

APPENDIX.

Name	Age	Disease	Operation	Nerves cut	Previous condition	Present condition
E. F. I.	14	Spastic paraplegia	June 30, 1910	D. XII–LII L. III, LV S. I	Walked with cane and crutches, had several tenotomies, myotomies and myomectomies with only temporary improvements.	Has been earning his living running an elevator, playing in the circus band and using a motor-cycle.
B. F. II.	20	Spastic paraplegia	June 1, 1911	D. XII–LI L. III–IV	Has never been able to roll over or touch his mouth.	Able to roll over, get on his feet and walk with assistance.
B. A. III.	3½	Spastic paraplegia	Sept. 7, 1911	D. XL, XII L. II, III V	Spasticity rather marked; hips and knees flexed and feet in equinus position.	Pronounced improvement, especially in voluntary control of legs. Can walk when helped by one hand toeing out considerably when so doing.

Name	Age	Disease	Operation	Nerves cut	Previous condition	Present condition
L. R. IV.	3	Spastic paraplegia	Oct. 21, 1911	D. XII–LI L. III–IV	Never been able to sit or stand. Legs are crossed and heels cannot be gotten together or to floor. Hands cannot be gotten to mouth.	Mother says child is "learning to walk fine." Lately has been standing without assistance and with leg splints can move about room by grasping furniture.
K. R. V.	4	Spastic paraplegia with hydrocephalus	Nov. 1, 1911	D. XI L. L. II IV. V	Died 9 hours after operation.	
B. P. VI.	20	Spastic paraplegia	Nov. 5, 1911	Cervical III–IV–V VIII VII–D. I,	See Case II.	Able to put a glass of water to his lips for the first time in his life.
G. H. VII.	4	Spastic hemiplegia	Jan. 17, 1912	Right side only D. XII L. I. III IV	Walked with foot in varus with typical hemiplegic gait.	Still toes in when he runs and plays, but when on parade, there is no limp apparent to casual observer.
M. J. VIII.	35	Spasm of cervical	May 18, 1912	Rt. C. IV V. VI LT. C. IV, V	Marked spasm of sterno-mastoid and trapezius with pain here and in hands.	No spasm of cervical muscles though still low occipital and finger pain.
W. P. IX.	4	Spastic	Aug. 1, 1912	D. XII–LI L. III–IV	Never succeeded in standing even when assisted up to time of operation.	Walked four months after operation. Is able to control knees very well and can voluntarily abduct his legs.
H. L. X.	8	Extreme spastic paraplegia	Aug. 31, 1912	D. XII L. I, III	Extreme spasticity of all four extremities. Unable to stand, walk or carry his hands to mouth.	At last accounts is able to walk with a little assistance.
L. W. XI.	8	Spastic paraplegia	Oct. 26, 1912	D. XII L. I, III IV	Unable to walk.	Walks with a little assistance.
H. L. XII	8	Extreme spastic paraplegia	Nov. 16 1912	C. III, V VI	See Case X.	Able to feed himself for the first time.

Name	Age	Disease	Operation	Nerves cut	Previous condition	Present condition
E. A. E. XIII.	23	Spastic paraplegia	Dec. 5, 1912	D. XII L. I, III IV	Scarcely able to walk with crutches. See details in text.	Is able to walk easily and without stiffness a mile and a half with a cane, and a quarter of a mile without a cane.
D. M. XIV.	7½	Spastic paraplegia	Feb. 25, 1913	D. XII–L.I L. III–IV	Died 1½ hours after operation apparently from shock.	

DISCUSSION.

Dr. J. K. Young, Philadelphia.—This paper is so important, and these cases so rare, that I think it well for me to refer to two that have come under my observation. Both were operated on by Dr. Frazier. One was a cervical and the other a lumbar case. The operation on the first was unsuccessful, and the second patient was made worse by it. The latter was a boy of fourteen years, and the shock was so severe that the operation had to be abandoned after performing the laminectomy. The operation was thus only partially performed.

Dr. G. G. Davis, Philadelphia.—I might mention a third operation of this kind done by Dr. Frazier. The patient was a boy thirteen or fourteen years old whom I had under my care for a while, and the condition in this case was markedly improved. He is still alive to-day.

Dr. R. B. Osgood, Boston.—I have been looking up some of the results of these operations, and, so far as I can discover, the best result achieved in the shortest time of which we know is that of Dr. Hunkin, which is a source of great satisfaction to the Association. Dr. Hunkin seems to make light of it, and he does it in a great deal shorter time than anyone that I know.

Dr. S. J. Hunkin, San Francisco.—The shock of the operation is in proportion to the time taken to perform it. The first operation we did took an hour. Since then we have rarely been over forty minutes, and we believe that it can be done in thirty. We feel that when we get through in thirty-eight minutes, eight minutes have been wasted because the nurses were not ready, on account of not being familiar with the operation. We had no shock in any but two cases. We think that this is due to the rapidity of the work and the method that we used.

XVI.

THE IMPORTANCE OF POSITIVE SUPPORT IN THE CURATIVE TREATMENT OF WEAK FEET AND A COMPARISON OF THE MEANS EMPLOYED TO ASSURE IT.*

BY ROYAL WHITMAN, M. D., NEW YORK.

In 1890 when flat-foot became of sufficient importance numerically to appear in the Report of the Hospital for Ruptured and Crippled, there were ninety-seven cases or 2.6 per cent. of the new patients treated in the orthopedic department. In 1906 the number had risen to 1219, or 18.3 per cent., and in the last report to 2109 or 29.2 per cent.

The significance of this affection, not only as a source of local pain but as a predisposing and aggravating cause of disability in the neighboring joints and of many other ailments, is now more generally recognized by the profession, while the popular use of the terms fallen or falling arches indicate, as contrasted with flat-foot, a better understanding of its nature, as an acquired weakness that may be prevented or cured.

One of my first cases in practice was one of painful flat-foot, of the type properly described by the term. Otherwise I should not have recognized it, since no other was described in the text-books and I am very sure that the subject was not mentioned at the medical school. I read that the arches of such painful feet having been flattened out by direct pressure must be supported, and I learned on inquiry that the way to obtain a brace was to draw the outline of the foot on paper and to send it, with a shoe, to the mechanic.

This support was simply an inner sole of metal, and at the present time, with more accurate adjustment, it is still the form used by the majority of orthopedic surgeons and worn by those who purchase them without such intermediary. There are many variations in the material of which it is constructed and also in the pattern. It may be elastic or rigid. It may, like the original, cover the entire sole or it may be cut down to the so-called orange peel, but the principle and design is the same, to directly support a flat-foot from beneath.

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* Read before the American Orthopedic Association, May, 1913.

This brace relieved the symptoms of which my patient complained and completed the treatment.

By this fortunate chance I was introduced to this important and neglected disability at an impressionable age, unembarrassed by previous instruction.

My first paper on the subject was published in the *Boston Medical and Surgical Journal* twenty-five years ago. It presented certain conclusions as to causes and treatment based on the anatomy of the deformity. These conclusions, elaborated from time to time in other papers in adaptation to the clinical development of the subject, although now generally accepted in theory, are by no means logically applied in practice. They are in brief as follows:

The essential disability of the so-called flat-foot is caused by lateral distortion.

The lowered arch is the secondary and not the primary deformity.

Pain is induced by strain upon sensitive tissues and has no proportionate relation to the deformity.

The more remote symptoms in the limbs and trunk are the consequences of the ungearing of the locomotive apparatus and the strain to which the mechanism as a whole is subjected by it.

The characteristic of all grades of weak foot is the persistence of the passive attitude of abduction.

In advanced cases this has become a fixed deformity. In the earliest stage it is a voluntary attitude that is abnormal because it persists when the foot is in active use.

It is because this attitude is characteristic and because it is the most important predisposing cause of disability that I have used the term weak foot in place of flat foot, which is anatomically incorrect and which directs attention to deformity rather than to impaired function.

If the attitude of abduction, when exaggerated to deformity, be analyzed, it will appear that the first and most noticeable change in contour is a lateral bulging in front and below the internal malleolus. This is caused by the inward and downward rotation of the astragalus, and in a lesser degree, the os calcis on which it rests, so that the posterior section to which the power is attached is twisted inward in its relation to the fore-foot or fulcrum. Incidentally the arch is lowered and the weight is directed toward the inner border of the foot.

Considering the weak foot as primarily an improper attitude which has become exaggerated to weakness and deformity, cure can be attained only by the substitution of normal attitudes and postures even to what may be called over-correction.

The relative efficiency of treatment may be judged, therefore, by its effect in restoring symmetry as the essential preliminary to improved function upon which cure ultimately depends.

There are cases in which the deformity is so slight and in which the interest of the patient is so acute that no local support, other than a properly balanced shoe, is required, the test being the ability to hold the foot in the correct position without effort.

If, however, the restoration of the normal incurvation of the inner border requires an exaggerated inversion of the foot, support is indicated primarily, as it would be indicated ultimately in any case, if on observation it appeared that the proper attitudes were not persistently maintained.

My point of view may be illustrated by the following experience. Several young men were referred to me recently for weak foot, who had on this account failed to pass the physical examination at the Naval Academy, but had been granted a second examination three months later. In all instances the deformity was slight and there were no symptoms of disability. Here, if under any conditions, one might count on the necessary concentration of purpose to voluntarily correct the attitude, yet having at my command a means of enforcing it, I applied in each case a positive brace, which was worn until the new attitude and postures had become habitual. This treatment was effectual and I was able to assure the authorities that such candidates, understanding the methods of self-protection, were in my opinion better risks than the majority of their classmates, in that they were assured against future disability by their knowledge of its causes and nature.

Support is indicated in the curative treatment of all but the mildest types of deformity in childhood, because one cannot command the cooperation of the patients, and it is unnecessary perhaps to call your attention to the importance of this disability as the cause of awkwardness and weakness and as the predisposing cause of a large proportion of the cases in which disabling symptoms first appear in later life.

In speaking of a brace to enforce correct attitudes and postures I do not refer to any of the sole plates, which I shall class as negative in type, because they have no such influence.

As the essential deformity of the weak foot is primarily a lateral bulging, it can be controlled effectively only by lateral support. Unless deformity is restrained, muscular power cannot be advantageously used. If symmetry is assured, the two segments of the foot being in proper relation, walking may be utilized as an effective exercise to strengthen the muscles that control the weakened part. A positive brace is therefore the most effective agent in lasting cure.

Although the importance of the weak foot is now so generally recognized, yet the standard of treatment is very low. This is explained doubtless by the fact that pain, the most intrusive symptom, is not proportionate to the deformity, but is simply an evidence of the strain to which the deformity predisposes. It is therefore readily relieved by any treatment that lessens the strain, whether it reduces the deformity or not. Thus palliation is often mistaken for a cure and is used as an argument against treatment designed to restore symmetry and mechanical efficiency.

On the one hand patients are subjected to laborious exercises which are in great degree ineffective because of the immediate relapse of deformity, and, on the other hand, deformity is partially restrained by sole plates or by stiffened shoes while exercises are completely neglected. Even when principles of treatment are intelligently applied it loses effectiveness because the support is indirect and negative in its action.

If I may assume that the brace which I have used for so many years to the exclusion of all others is familiar, yet I am sure that the principles of its construction and methods of employing it to best advantage are appreciated by very few.

It is an instrument of precision and it must be properly adjusted. The first essential therefore is a cast of the entire foot in the corrected attitude. This must be taken with the foot lying on its outer border in the exact position in which it should rest in the shoe, the abduction being corrected in great part by the position and by the weight of the limb. This cast is necessary, because presenting a cross-section of the leg, it shows the character of the residual deformity and the secondary changes induced by it, and this aids one in determining the degree to which the model may be still further changed with advantage. Usually the base is somewhat deepened posteriorly, where the elongated heel encroaches on the arch. The outer border, which is often flattened by pressure, is rounded at its base by the addition of a little plaster and the sole is made even. Upon this, the outline of the brace is drawn for the mechanic. A broad internal upright covers, and rises above, the astragaloscaphoid articulation. A similar flange, whose center covers the calcaneocuboid articulation, extends from behind the poste-

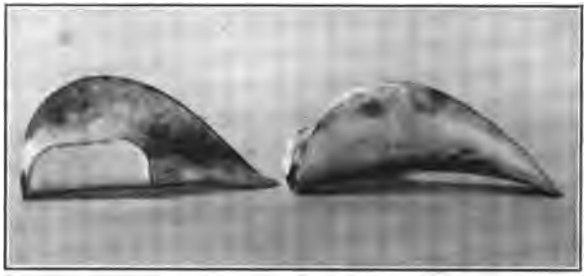

FIG. 1.—The inner and outer flanges.

rior tubercle of the os calcis to a point behind the base of the fifth metatarsal.

The sole plate at the back crosses just in front of the bearing surface of the os calcis and extends anteriorly to the bearing surface of the great toe joint and runs diagonally across the sole to join the outer flange.

This brace inclosing the foot laterally must prevent lateral distortion and the descent of the arch which accompanies it. Thus the sole of the foot though supported is not subjected to direct pressure, and it never presents the atrophied, excavated appearance so often seen when the weight has been supported on a negative plate.

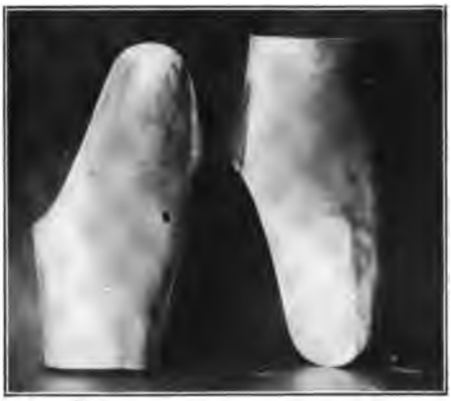

FIG. 2.—The shape of the side plates.

Furthermore, when the brace is properly adjusted in a balanced shoe, the weight falling first upon its outer border presses the inner flange against the inner part of the foot at the time when, if unsupported, it would incline inward.

This leverage action not only aids in restraining direct deformity by the suggestive pressure, but it prevents outward rotation of the limbs and thus directs the weight in walking upon the diagonal fulcrum formed by the heads of the metatarsal bones and away from the weakened arch. A brace that will not only prevent deformity, but the predisposition to it as well, that will enforce a proper attitude in walking and thus make it an involuntary curative exercise, may be regarded as an active, positive, and most important adjunct in curative treatment.

I wish to call particular attention to these features that distinguish this brace from all others because it is applied in most instances by those who have little understanding of the principles of its construction and use.

For example, the cast is usually made as for the ordinary sole plate by a direct impression of the foot in plaster. Such a cast is invariably wider than one in which the deformity is corrected by posture, nor are the landmarks evident that would enable one to change the shape intelligently. As a rule the brace does not fit closely enough to completely restrain lateral deformity and it is often otherwise modified. For instance, the sole plate is made broad in front; it is often extended backward to cover or even to enclose the heel; the base is flat and the outer upright straight and narrow. These changes, in direct proportion as they differ from the original, lessen its efficiency, particularly its active or leverage action.

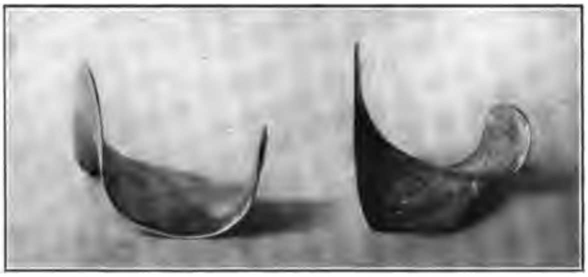

FIG. 3.—The contour and balance.

To make the moulds in the correct manner requires no longer than fifteen minutes and if the casts are properly prepared and the braces accurately made, very little adjustment is necessary, other than to bend the margins here and there as they press upon the foot or project from it. If material changes are required, as for example to follow the improving contour of the foot under treatment, new casts should be taken and new braces made.

The lightest, strongest and on the whole the most satisfactory material for the brace is thin, polished steel, galvanized to prevent rusting. The support should be practically unyielding under pressure. Elasticity, or resiliancy even if practicable would be undesirable, since a principle of treatment is to prevent that degree of relaxation which might be normal under other conditions. Over-correction is maintained as far as possible, when the feet are not supported, by inverting them in walking and the prescribed attitudes and exercises are all directed to the same end. In this connection it may be stated that the attitude of relaxation or rest, which simulates deformity and which predisposes to it, may be discontinued with advantage even in normal subjects who stand much of the time, since it is in reality far more restful to direct the weight in standing upon the outer than upon the inner border of the feet.

A criticism often made by those who appreciate the mechanical advantages of this brace is that it is difficult to adjust and uncomfortable to wear, a criticism that would apply to any instrument of precision designed to restrain habitual deformity. That these obstacles are not insuperable is indicated by the fact that more than 1200 pairs were applied at the Hospital for Ruptured and Crippled during 1912, and more than 1500 pairs were made by one private brace maker during the same period.

Naturally one gains facility with experience, particularly in changing the plaster models and in modifying the braces in adaptation to the local conditions. Another important point is the control of the patient during the period of adjustment. He is instructed that he must adapt his attitudes to the braces, in place of having the braces adapted to a measure of deformity. When the adjustment of the support to the foot and the adjustment of the patient to the brace have been satisfactorily accomplished, it is the most comfortable, the least conspicuous, the least restrictive, and the most efficient of all supports.

The essential accompaniment of positive support is a proper shoe, inclined somewhat outward by thickening the inner border of the heel and sole in the well-known manner.

The model that I have used was described many years ago in an article on shoes. The essentials are the pronounced right and left shape, and a narrow flexible shank that permits the leather to fit closely beneath the arch.

It is of course evident that all shoes are, in varying degree, supports. The shoe usually styled "orthopedic," with a wide-braced shank and stiffened laterally with leather, is simply a cumbersome brace which, in relieving symptoms, discourages effective treatment. Such shoes are worn unwittingly by those who would avoid braces, which are supposed to weaken the natural supports of the foot. The same belief encourages treatment by simple gymnastics which must be ineffective unless deformity is restrained. A positive brace is applied to hasten a permanent cure, which shall enable the patient to dispense with all support whether direct or indirect.

This paper is limited in its scope as its title indicates. The points to which attention is called are these:

The weak foot is, in most instances, an acquired disability which under favorable conditions may be cured, and this, rather than relief of symptoms, should be the aim in treatment.

The weakness is due to deformity and the impaired function that accompanies it. The first indication therefore is the restraint of deformity, since symmetry, or in other words the normal relation of the joints, is essential to normal function. Effective treatment should prevent, not only actual deformity, but on the principle of over-correction the attitudes that predispose to it, as well.

Such restraint must be of necessity primarily lateral, since indirect support cannot be efficient in the same sense.

If the analysis of the nature of the disability and deformity be accepted, the principles of the treatment, as here outlined, must be accepted also, and the only question is one of standard in its application.

DISCUSSION.

Dr. Osgood.—I have been much impressed by Dr. Whitman's paper. I have sat at the feet of Dr. Whitman and tried to learn the method, which I have used to a considerable extent. I have not, however, acquired the speed which is possible with Dr. Whitman. It takes me longer than fifteen minutes to take the cast by his method.

Now in regard to the question of a permanent brace: If we cannot make the foot do its own work, we may use Dr. Whitman's perfected appliance. If we can secure the desired result in any other way, however, I think that we must relieve our patients from the burden of steel. Our efficiency will be measured by our skill in doing this. It can be done, and is done constantly by various methods besides the use of the Whitman plate or the so-called Boston plate.

Dr. W. E. Blodgett, Detroit.—I am glad to have the opportunity to hear Dr. Whitman's paper, because I have had a good deal of plate work to do, and have formulated certain beliefs about it. I have divided plates into two classes: orthopedic plates, as represented by Whitman's, and arbitrary plates, as represented by the so-called Boston plate. The orthopedic plate may be compared to the effort to approximate mothers' milk by a modification of cows' milk. It is an attempt to reproduce the natural sole of the foot. It may be noted, in this connection, that at the present time, if I am correctly informed, pediatrists find that the best artificial food for infants is a wide departure from the nearest chemical approximation to mothers' milk. It has been my experience that the best pain-relieving plate is one that is arbitrary, and does not attempt to imitate the contour of the sole. In other words, the plate that I make is simply a device for relieving pain, without itself producing pain. It is in no sense a curative plate. If Dr. Whitman's is a curative plate, it must be valuable; but if this is the case, I think we are all agreed that it cannot be painless. It sometimes relieves the pain, but it often produces new pain. The question is whether we shall allow that on account of the curative properties of the plate. Now, is it curative? This point must be decided, either practically or theoretically. From the practical standpoint, I cannot speak. I do not know Dr. Whitman's work well enough to speak of the practical curative results of the use of his plate. Theoretically, however, arguments can be urged against the assumption that it is curative. It artificially holds the foot away from its abducted position; but I cannot say that, as developing active power in the foot, I should prefer to wear a brace that runs up the side of the foot, throwing the ankle into abduction, thus allowing the soft structures on the inside of the foot to contract, and those on the outside to lengthen. As for strengthening the muscles, I cannot see that this plate of Dr. Whitman's can be expected to prove effective in this respect. Therefore, if it is not curative, why should we permit its use?

Dr. H. Augustus Wilson, Philadelphia.—In my efforts to teach my students the therapeutic measures that should be adopted for this condition, I have endeavored to establish a standard of what is natural. On one occasion there was in Philadelphia, some four years ago, a troop of Igorrotes; and I had twelve or fourteen of these little people come to my clinic, as I wished to show the students what natural feet were like. The subjects varied from five to forty-two years of age, and I put them on a high platform; but, as they walked across it, I was horrified to find that I was wrong in my conception of a natural unclothed foot. These people, in whom I had expected to demonstrate a perfect arch and a perfect foot, all stood flat-footed, with the feet pronated in the position that I had used to demonstrate the necessity of mechanical support; yet they had superb, flexible feet, superb musculature, and capabilities beyond conception. If plates had been applied, they would have had beautiful arches. My students were also appalled, because I had taught them that a natural foot should stand foot-straight, with the arch preserved. I was aghast at the prospect of not being able to reconcile the feet of the savages with my conception of a natural foot; but, through the suggestion of one of the students, I was finally able to show them that even though these feet appeared pronated when standing, their arches in action were the standard normal arches. Therefore, the foot was a capable foot. Hence, Mr. President, it seems to me that we are considering a theoretical foot when we apply any therapeutic measures—whether it be a rigid brace, a physical (or physiological?) motion, or foot plating. If we can get in our minds a standard natural foot, we shall have something on which to build a superstructure. The Japanese have been held up to us as the nearest approach to the natural in their feet, and these also are capable feet. These people walk without heels, and the result is that the flexors are strong and powerful. They walk with their toes in, and have foot capability beyond conception; yet when standing, they are apparently flat-footed, because their feet are largely pronated. When we look at patients with whom we have to deal, who have had their feet vitiated by improper clothing, we can see that the shoemaker's life is a happy one in finding so many patients who need mechanical support. My difficulty has been to know when to take out supports that have been put in by others, so as to have the patients get a natural foot. I took out plates from the shoes of one patient who had worn them constantly for fourteen years. She complained of weak knees, and I found that her calves were atrophied from disuse of the strong muscles of the leg and her pain had migrated to a position in the upper ambulatory apparatus. What we are after, I think, is not the physical resemblance of a foot, but a physiological action.

Dr. Philip Hoffman, St. Louis.—I am glad that Dr. Wilson spoke as he did, because, if I had done so, you might not have believed me. The question is whether the relationship between the shape or form and the function of the foot is a definite one, as Dr. Whitman believes. Dr. Wilson spoke of some Igorrotes that he examined in Philadelphia. In 1904, during the World's Fair at St. Louis, I made observations on four or five hundred primitive bare-footed and sandal-wearers. I found the same lack of relationship between the form and the function of their feet, which were pronated to such a degree that the arches were very low. I went through the different native villages accompanied by interpreters; and when I came across a foot that, according to our standards and the ones I then believed in, should predispose to weakness, I was careful to examine the person through the interpreter, in order to learn whether any symptoms of weakness had ever been present. In not one of these four or five hundred individuals had symptoms been present. In fact, in the whole group there was not a foot with symptoms of functional static trouble, such as we have in shoe-wearers. I thought that this was merely a characteristic of these people. Among them were some Malays and some Central and South African people. Most of the latter had been shoe-wearers since the Boer War, and I found in them the same percentage as in the others. I had a certain standard of arch fixed in my mind, which I considered normal, and which was what was then the conception of the normal arch. I grouped all the cases into six classes, marked *a*, *b*, *c*, *d*, *e*, and *f*. Of course, there were really as many different types of arches as there were individuals; but I put them into the group they most resembled. I found that 60 per cent. were of a type below what I considered the standard. Fifteen or 20 per cent. were on the border line. If they presented symptoms, I should have considered them low; if not, they were considered normal arches. In the South Africans, I found the same thing. Then I tried 200 white shoe-wearers, men whom I carefully selected in St. Louis. I inquired whether they had ever had foot symptoms and selected those who had not; and I found about the same proportion of pronated and low arches in these symptomless feet. Then I examined a number of negro feet, and found the same proportion of low arches and pronation in the symptomless negro feet. I was therefore forced to the conclusion that there is no definite relationship between the shape of the foot and the function of that foot, as regards the arch function, at any rate, and the symptoms of strain that might be present in the foot. I then took occasion to tabulate a number of cases of feet presenting symptoms (fifty), and found the same average of the different types of feet that presented symptoms as I had found in the other classes of cases that were symptomless. I believe that the arch will usually break and become lower in feet that present symptoms, but I think that an arch rarely changes to a marked degree, such as from a high to a low type.

Dr. Charleton Wallace, New York City.—It is my opinion that most of the difficulty with using the Whitman brace has been in trying to apply it to an unsuitable foot. For use in my office and elsewhere, I have devised a system of classifying the types of feet that happen in. In the first class, I put the mild cases that show no symptoms of pain, and can easily wear the Whitman brace with more or less comfort. It takes a week or ten days for the patients to get their feet used to it, but the result of its use is very quick. The brace, the shoe and the exercise give one perfectly satisfactory results. The second type of cases are those in which the peroneal spasm is rather strong, and must first be overcome before the Whitman brace, the one with the inner flange, can be used. When this spasm has been overcome, so that the tarsus can be abducted from the inner flange, the foot will bear the brace comfortably. The third type includes the rigid, stiff feet. In these, the foot must be put in adduction and the peroneal spasm be overcome, so that the fort is made flaccid. They can then wear the brace comfortably. We do not expect the Whitman brace to cure the foot. It is an aid toward the cure, however. The other aids are the shoe and the exercise. The shoes are put on with the aim of throwing the weight along the outer part of the foot and holding the foot properly on the brace. If the shoe does not fit properly, the brace may slip around in the shoe. Do not, therefore, put a new Whitman brace into a poorly fitting old shoe. If you do, you will lay the trouble to the brace, but it will be caused by the shoe. The third aid in the treatment of feet is muscular exercise, which is intended to stretch the peroneal group of muscles and to strengthen the muscles and ligaments, so that they will functionate properly when the weight is put on the foot. Ninety per cent. of the cases in my office are treated to the patient's satisfaction, although perhaps not to mine. If one gets satisfactory results to the patient in 90 per cent. of the cases by this means, it is hard to go further and secure better results. The 10 per cent. of failures may include neurasthenic cases and cases that cannot stand any pressure from a steel brace. The Whitman brace cannot be applied to a stiff foot or to one with spasm. One must first educate and develop the muscles and overcome the spasm. One can then restore the arch and relieve the pain, and the patient can go about his business in the proper way.

This is something in which we are all interested. I have had the good fortune to work under Dr. Whitman for a good many years, receiving his abuse and his instructions during that time. I want to say that if, in these cases, the braces are changed when the arches have become elevated and the deformity is gradually disappearing, the second pair of braces will further correct the deformity and you can gradually get the foot into a normal position or attitude. That position, however, will not be maintained unless the muscles are strong enough to hold it. Therefore our whole aim is to cure the foot by strengthening the muscles, giving the foot a crutch, as it were, to walk on while being corrected.

Dr. John Ridlon, Chicago.—I want to call the attention of the Association to the remarkable statistics furnished by Dr. Whitman regarding the progressive and great increase in the number of cases of flat-foot in New York. Now we see them in Chicago in just the same way; and, so far as I can judge, the condition is prevalent throughout the country. The number of cases of flat-foot that we are treating, and the many times that number that are wearing foot-plates bought in shoe stores, is appalling. A good deal more than half the adult population of the country are being treated for flat-foot. Now is it a fact that flat-foot has increased to such an enormous extent? If it has, there is something decidedly wrong. I do not know whether there is something wrong or not, but there is one thing that has been done in the past two years that may or may not account for it, which was not done before. The orthopedic profession have turned the shoemakers and manufacturers to making crooked shoes, with the front turned around into adduction. I suspect that it is that crooked shoe which has been the cause of all this enormous increase in flat-foot; and I want you to give the subject attention for the next year or so, in order to see whether it is or not.

Dr. Arnold, New Haven.—The statistics presented by Dr. Whitman may, I think, have another explanation. I believe that the increase in flat-foot was noted before the crooked shoe came in; but there has been a change in our life that is much deeper-going than the crooked shoe. Within the experience of all of us, the American sidewalk has changed from a soft to a hard one. In a soft walk the foot shapes the ground, but on an unyielding one the sidewalk shapes the foot. Therefore, the type of foot of the savage can no longer be considered as a type of foot that will sustain us without pain under modern conditions. You will find that the Indian, the colored man, or the Japanese will go to pieces on our sidewalks and contract flat-foot; or, if he had it before, it will suddenly become more painful. If you take an unyielding flat-foot or one with no symptoms of pain and have its possessor walk on soft pavements, you will find that just as soon as he commences to impress his foot on the ground and shape the ground to suit his foot, he will have a flat-foot that is without pain. Walking on hard ground is one of the etiological factors in flat-foot. I do not say that it is the only etiological factor, but it is one that goes rather far in explaining the great increase in this condition. The front part of the foot with its small muscles, mainly for maintaining equilibrium, is put out of commission by walking on streets on which it cannot make an impression. The person loses function in the muscles of the foot; they weaken, and the foot becomes flat. The question as to how far any plate will cure flat-foot in these conditions is answered by the conditions under which one is going to make use of the foot. I do not think that any foot will be cured unless it adapts itself to the new shape of the pavement. People ought to be born with rubber-tired wheels under them. Children are relieved of all pain, if you put that theory into practice and recommend them, as I do, to use roller-skates instead of walking. As soon as they do so, the symptoms disappear.

DR. ARTHUR H. CILLEY, New York City.—As the smallest dog makes the most noise, the smallest deformity will also do this. Therefore one cannot go always by what the patient says in planning a method of treatment or in judging of its results. Some men will treat a so-called flat-foot by means of a control plate, and another will use a Whitman plate. This is on the same principle as one will treat hip-joint disease with steel, and another with plaster. One man can use one particular form of treatment with advantage, and cannot use the other, which, in the hands of another man is very successful. The result does not depend upon the form of treatment, but upon the ability of the man to do the work with it. If one man can make a proper cast and has a mechanic who is able to follow the cast, he will have a plate that will cure, if the patient will use it properly. If the patient uses it as a support, he will get worse; it makes no difference what plate is used. The trouble is the lack of balance, the lack of use of the intrinsic muscles of the foot. If the patients will use the muscles, they will get well. If the Whitman plate is properly applied, they cannot help using these muscles. The patient who cannot get used to a Whitman plate in a short space of time, if his is a proper form of foot for that treatment, is very unusual.

DR. WHITMAN, in closing the discussion, said in reply to Dr. Osgood that he had not intended to give the impression that the sole plate was a Boston brace. It was of unknown and very ancient origin.

The basis of his argument was that a normal attitude of abduction or relaxation became abnormal when it became habitual.

This abnormal persistence of abduction was absolutely characteristic of the weak foot, whether the patients were brought for treatment because of awkwardness or weakness, as in young subjects, or came because of pain and disability in later years. The indication in curative treatment was, therefore, the prevention of this predisposing attitude, not only in activity but, on the principle of over-correction, at all times.

The observations of Dr. Hoffman were of interest but not pertinent since what might be normal in a primitive person was abnormal in one predisposed to weakness.

The question might be reduced to simple mechanics. If the relation between the power and the fulcrum were made indirect by abduction, the machine did its work at a disadvantage and was subjected to abnormal strain.

It was true, as suggested by Dr. Blodgett, that in many instances this disadvantageous attitude might be habitual without disability and that discomfort might be relieved by treatment that did not restore symmetry, but this argument had little weight since it applied to every other weakness or distortion of the human machine. Furthermore the habitually abducted foot was generally recognized as unlovely, to say the least, and as appearance was in the estimation of many individuals of equal importance with utility. It should receive the same consideration.

This paper was on curative treatment and Dr. Whitman believed that he had indicated the principles by which this might be accomplished in a large proportion of the cases. Since he was able to supply the practical experience lacking in Dr. Blodgett's criticism.

The question was therefore simply of standard, first of aim and second of means.

A positive brace being an instrument of precision was, because of its effectiveness, difficult to adjust and this should restrict its use to those competent to apply it, in distinction to the sole plate, which in most instances was applied and worn without medical supervision.

Dr. Michael Hoke, Atlanta.—You must not forget the mechanics of surgery, and that it is possible to have a rheumatism in association with flat-foot and be a factor in the causation of pain. A great many of these feet are painful on account of that factor, and I often decline for this reason to apply a foot-plate.

XVII.

THE TREATMENT OF HOLLOW FOOT (PES CAVUS).*

BY GWILYM G. DAVIS, PHILADELPHIA.

By hollow foot or pes cavus is meant a deformity of the foot, the main characteristic of which is an elevation or increase of its arch. It may be associated in its various forms with elevation, equinus, or depression of the heel, calcaneus, or a tendency to inversion, varus, or eversion, valgus.

We may divide it into two varieties, one the spasmodic, irritative or nonparalytic type and the other the paralytic type.

Nonparalytic Pes Cavus.—The pathology of these nonparalytic cases is obscure. They are absolutely different from the paralytic type and require different treatment. In nonparalytic cases the foot is, as a rule, short, thick, muscular, contracted and possessing apparently a surplus of energy. Strength is its characteristic. A careful examination and trial of the individual muscles will show that while some may be weaker than others, there is no paralysis of any of them. The presence of the deformity is evidence that there is lack of muscular balance and if there is no paralysis, then the distortion is probably the result of over-action on the part of the muscles producing the deformity. These feet and legs do not show the trophic changes seen in paralytic cases. When the history is investigated, we find there is an absence of any attack of poliomyelitis and that instead of the disease being of long duration and dating from infancy that it is an effection comparitively recently acquired and is perhaps most frequent in adolescents and young adults. Instead, also, of the deformity being more or less suddenly acquired as in the paralytic form it is of gradual formation and has progressively gotten worse.

The cause is to be looked for in some irritative factor, probably unsuitable foot wear and strain due to excessive use or unsuitable habits or occupation. The deformity seems to be the result of a protest of the foot against discomfort to which it has been subjected and anything that causes discomfort predisposes to it. A short shoe, a narrow shoe or an ill-shaped shoe all tend to make undue pressure on the toes, this results in a contraction of the tendons which then retract the toes and so relieves them of pain. It is easy to conceive how the persistent wearing of ill-fitting shoes should serve as a cause of the deformity which is found. The condition present certainly consists of a more or less permanent irritation, spasm or contraction of the muscles. As the flexor muscles are stronger than the extensors, we find the foot assuming a position of plantar flexion, also an increase of the plantar arch. There may be equinus, accompanied by arching of the phalanges—hammer toes. If there is lateral deviation it is in the direction of the varus—inward—not valgus.

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* Read before the American Orthopedic Association, May, 1913.

While it is usually easy to decide whether a given case is of the irritative or paralytic type, occasionally one is seen in which the condition present, judged by the history of the case, may be due to a previous slight paralysis which while sufficient to disturb the muscular balance and thereby start the trouble has yet been so recovered from as not to show any present signs of paralysis. These cases are to be regarded and treated as belonging to the irritative type.

Treatment of Spasmodic, Irritative or Nonparalytic Pes Cavus.—The foot should have the deformities eliminated, the muscular spasm stopped and finally should be protected against future discomfort and insult. To lower the elevated arch tenotomy of the plantar fascia and perhaps the tendon of the flexor longus hallucis should be done and then the foot should be forcibly stretched either manually or over Koenig's wedge block or, if it is extremely resistant, by using instrumental means, such as the Thomas wrench or some of the many forms of club-foot stretchers. Tentomy of the contracted muscles is advisable. If the heel is raised the tendo-achillis should be divided; if marked spasm of the peroneal or anterior or posterior tibial muscles is present their tendons should be divided. If the toes are drawn back causing them to arch dorsally and if when traction is made on them the extensor tendons are made tense then these should also be divided. The only digital flexor tendon that it is usually advisable to divide is the flexor longus hallucis. The necessity of its division is evinced by its being made very tense by tension on the big toe. Recovery from these procedures only takes a few days and then shoes should be applied. These should be made with the idea of affording comfort and preventing recurrence. To do this the shoe should be at least three sizes over all longer than the foot; should be a straight and not a spring last; should be sufficiently wide, with room for the toes; possess a shank stiffened with a strip of steel and in some cases having a strap passing across the instep twice—over and back—to press the foot firmly down on the sole of the shoe. It is not desirable at this time to discuss other individual phases of treatment used, often early in the course of the affection, such as the use of anterior pads and supports like Cooks "anterior heel" and the operation of Forbes of Montreal to raise the head of the first metatarsal bone by transplanting the tendon of the extensor longus hallucis muscle into the first metatarsal bone, and other means which are of value in rendering uncomfortable feet comfortable.

Paralytic Pes Cavus.—The pathology of paralytic pes cavus has also not been so completely solved as is desirable. Until comparitively recently its treatment has been unsatisfactory. It is found in various forms. A clear history of an attack of poliomyelitis is usually obtainable, but this is not always the case. Sometimes the amount of paralysis is comparitively slight and while the deformity present may be marked, it may have been of gradual growth. I am firmly convinced that some of these cases have suffered from an attack of poliomyelitis in infancy or early childhood from which recovery has been thought to be perfect, but which in reality has left a slight muscular paresis. This attack then is forgotten and no further history of it is obtainable. The child may have had such a slight impairment of gait as to have passed unnoticed in its earlier years, but when it reaches adolescence the dormant weakness is revealed and the abnormal atrophy and lessened reflexes betray its cause. An absolutely positive diagnosis, however, in some of these cases I suppose can only be made when the reaction of degeneration is present in the affected muscles. The foot is a weak foot, it is smaller in size than the healthy one and this is the case also with the leg. The contractions which are present are not active contractions such as we have seen to be characteristic of the irritative or nonparalytic form, but they are passive contractions consequent on malposition and disuse. Pain, so prominent in the irritative type, is absent in this form. The deformity is marked and the disability great. The paralysis never increases but if it does not improve the deforming influence of weight and functional attempts at use progressively aggravate the deformity. As it exists clinically pes cavus is seen in many varying shapes and conditions. It may exist alone, which is not frequent, or it may be associated with toe drop or lateral deviations due to the varying character and extent of the paralyses present.

The true cavus foot is accompanied by a depression of the heel constituting a calcaneus deformity. When there is a paralysis of the muscles of the calf it seems that the pressure of the body weight on the plantar arch is not sufficient to keep it in its normal shape and we find the other muscles of the foot overcoming the effects of gravity and causing an increase in the arch. In rarer cases the os calcis retains almost exactly its proper relation to the leg but the anterior portion of the foot, owing to paralysis of the extensors, drops, subsequently contraction of the tissues of the sole occurs and a more or less typical cavus condition develops. Should the abductors or adductors be also paralyzed then in addition to the cavus or calcaneocavus a deviation of the lower portion of the foot occurs outward, constituting a valgus, or inward, constituting a varus. In some cases a contraction of the tendo-achillis follows paralysis of the calf muscles. When this is associated with a certain degree of paralysis of the peronei (abductors) and extensors then we have a condition of more or less hollow foot associated with equino varus. This condition, however, is not usually considered to be a case of cavus but is usually designated as paralytic club-foot. In order to appreciate the principles of treatment of these paralytic deformities it is essential that one should know something about the joints of the foot. There are so many joints in the foot that when a deformity occurs it is a matter of necessity that more than one, and it may be several, are involved. Notwithstanding this, for practical purposes, the principal location of the lesion in one or more of three joints. These joints are the ankle-joint; the subastraloid joint and the midtarsal joint.

The up-and-down movement of the foot as a whole takes place at the ankle-joint. This is composed of the tibia and fibula above and the body of the astragalus below. When there is a falling of the anterior part of the foot the midtarsal joint is probably most affected. This midtarsal joint is composed posteriorly of the head of the astragalus on the inner side and the anterior extremity of the calcaneum on the outer side. It is composed anteriorly of the scaphoid on the inner side and the cuboid on the outer side. In dropping of the anterior portion of the foot, however, the lesion is not located so definitely in a single joint as is the case when the ankle- and subastragaloid joints are affected but the other small joints anteriorly also participate. For this reason operative procedures on the midtarsal joint are not so frequently resorted to, nor are they so efficient as is the case with the other two joints. When the foot deviates or rotates on an axis parallel with the length of the foot and turns inward (supination) or outward (pronation) this movement occurs in what I call the subastragoloid joint. The astragalus remains fixed, being wedged between the two malleoli and incapable of lateral motion; it is the portion of the foot beneath the astragalus which moves or slides or rotates in and out. This subastragaloid joint is composed above by the astragalus, below by the scaphoid and inferior calcaneo-scaphoid ligament anteriorly and the calcaneum posteriorly. This is the joint that is affected when a condition of varus or valgus is present and the ankle-joint when the condition is equinus or calcaneus.

Treatment of Paralytic Pes Cavus.—The treatment of paralytic feet is difficult because of the many various muscles affected and the varying degrees of their paralysis. There is no standard treatment applicable to all cases.

These cases of paralysis are not to be subjected to operation until all hope of improvement and restoration of function by conservative treatment with exercises, braces, etc., has been abandoned usually from two, three, five or more years after the initial attack. When the hollow foot is slight, the os calcis retaining approximately its normal position, and only the anterior portion of the foot dropping, the disability and often the deformity is comparatively slight. The aim of treatment is to support the anterior part of the foot. The ordinary shoe helps considerably to do this and these cases will frequently rely on this and refrain from applying for treatment until the deformity becomes marked. The efficiency of the shoe as a support is increased by first having the shank stiffened by the insertion of a slip of steel and secondly by having the arch of the foot pressed firmly down to the sole of the shoe by means of an instep strap. This strap should be long enough to pass twice across the dorsum of the foot. It is to have one end fastened to the inside of the shoe, close to the sole, and at a point just in front of the external malleolus. It is then carried over the tongue of the shoe, then through a slit in the opposite side and through a metal loop or another buckle fastened near the sole. From here, after the shoe has been laced, it is carried back over the instep and fastened on the outside by a buckle low down just in front of the external malleolus. By means of this doubling of the strap on itself and pulling it tight, its power and security is increased, the foot is pressed firmly down on the unyielding sole beneath and the anterior portion of the foot is thereby prevented from falling and the hollow of the foot increasing. In slight cases this suffices, but when the condition is more marked the patient should be anesthetized and the arch forcibly depressed, either manually or by the use of the osteoclast or other mechanical means. When it is desired to aid an especially marked case or to do away with the necessity of using the double instep strap or specially constructed shoe then one is tempted to resort to operative measures.

We have tried shortening of the extensor tendons but while it helps it is not entirely satisfactory. The insertion of silk ligaments extending from the tibia above to the tarsal bones below is more satisfactory. The insertion of intraarticular silk strands after the method of Bartow and Plummer tends to limit the movements of the ankle-joint and that we wish to avoid. We hardly regard the solution of this question as being as yet satisfactorily settled and it is comforting to know that a certain amount of toe drop produces almost no deformity, but a slight amount of disability, and is usually endured uncomplainingly by the patient. We are not convinced as yet that an arthrodesis of the midtarsal joint is better than the use of silk ligaments. In considering the treatment or correction of the heel deformity, when it is raised (equinus) it is an easy matter to lower it either with a subcutaneous tenotomy of the tendo-achillis or lengthening by splitting and sliding the ends, done either subcutaneously or by open incision.

When the heel is lowered (calcaneus), to correct it is a more intricate and difficult procedure. If the plantar fascia is divided and the arch forcibly depressed and the heel thereby elevated the tendo-achillis is relaxed. One can, through an open operation, shorten the tendo-achillis but our experience with tendons shortened in this manner has not been satisfactory. They seem, after a comparatively short time to stretch and allow the heel to descend and the calcaneus deformity to again be reproduced. In special cases a certain amount of power may be transferred to the heel by dividing and transplanting the posterior tibial and peroneus longus and brevis tendons. It is obvious that as these tendons are essential to the proper control of the lateral movements of the foot their removal to the os calcis will weaken the foot and it is liable to assume a varus or valgus deformity. For this reason it is practically essential or desirable in most cases in which these tendons are transplanted to operate on the tarsal bones in such a manner as to produce an arthrodesis of the subastragaloid joint. The obtaining of a bony ankylosis in proper position of the constituents of this joint of course eliminates the possibility of the occurrence of a resultant lateral deformity. We do not consider it desirable to transplant any of the extensor muscles to the os calcis in order to raise the heel. Operations on the tarsal bones and joints to aid in the correction of equinus and calcaneus will be discussed later on.

In attempting to correct the lateral deformity which is caused by a turning of the foot at the subastragaloid joint, either inward or outward, muscle transplantation is often of service. A simple tenotomy of the contracted tendon on the elevated side is unsatisfactory: to do this makes both sides weak. If the foot is in a position of valgus the tendon of the peroneus longus can be transplanted to the scaphoid bone on the inner side of the foot. If the foot is in a position of varus it may be corrected by transplanting the tendon of the tibialis anticus to the cuboid bone on the outer side of the foot. The transplanting of these two tendons for the correction of lateral deviation is in suitable cases fairly satisfactory. Another efficient procedure to aid in lifting the head of the first metatarsal bone is the operation of Forbes of transplanting the proximal end of the extensor longus hallucis well forward into the shaft of the metatarsal bone of the big toe. In doing this we either pass the tendon through a hole drilled in the bone or fasten it to the bone by means of a chromic catgut or silk strand passed through a hole in the bone and quilted into the end of the tendon for about an inch. The distal end of the cut tendon can, if desired, be united to the adjoining extensor communis tendon but even if this is not done, the extensor brevis seems to be fairly efficient. The value of tendon grafting or transplanting depends on the judgment which is exercised. If the calf muscles are completely paralyzed it will not likely to be satisfactory to rely solely on transplanting the peronei and posterior tibial muscles into the os calcis. Transplanting the tendons of paralyzed muscles is practically useless on account of their subsequent stretching. For the same reason transplanting the tendon of an active muscle into that of a paralyzed one is also not to be recommended, it is better in these cases to connect the end of the active transplanted tendon to the bone by prolonging it with a silk ligature. When the paralysis of the calf muscles is complete and the depression or calcaneus position of the heel marked, calcaneocavus, and also in those cases in which a more or less marked flail foot exists, then operations on the soft parts alone are insufficient and procedures on the bones and joints must be resorted to. Of these procedures, that of Whitman was first proposed (*American Journal of the Medical Sciences*, Nov., 1901). It consists in excising the astragalus through an external incision then displacing the foot forward until the external malleolus is over the calcaneocuboid joint and transplanting the peronei muscles into the heel. Another operation has been proposed by Mr. Jones of Liverpool. He makes a transverse perpendicular section of the tarsus immediately in front of the ankle. The anterior portion of the foot is then pushed up toward the leg until it almost or quite touches it. This brings it in line with the depressed os calcis. When healing has taken place in this position a second operation is performed; a wedge with its base posterior and embracing the lower ends of the tibia and fibula and upper portion of the astragalus is removed and the foot brought down at right angles to the leg and allowed to heal in that position. In considering the value of these bone operations, it is to be borne in mind that they are all difficult procedures from a technical operative standpoint—that they require the most exact care to secure firm healing in a proper position and they should be carefully watched and subsequent deformity guarded against by support given by braces, shoes, or fixed dressings until permanent fixation has been secured. The procedure of Whitman when successfully performed has I believe been quite generally used. When successful the shifting of the point of support forward corrects the calcaneocavus condition and the amount of subsequent exudate seems to fix the foot sufficiently firmly to prevent or correct the varus or valgus. A certain amount of ankle-joint movement is also preserved. It removes, however, one of the most important bones of the tarsus. The foot is composed naturally of two parts or arches, an inner and outer. The outer is formed by the os calcis, cuboid and outer two metatarsals; the inner is composed of the inner three metatarsals, the three cuneiform, scaphoid, astragalus and again the os calcis posteriorly. The removal of the astragalus weakens very much the foot; in itself it is quite a deforming procedure and its loss materially shortens the total length of an extremity which is already disproportionally short when compared with the opposite side. The procedure of Jones is quite extensive, requires two distinct operations and leaves a stiff foot firmly ankylosed to the leg. For this last property it is most suitable for those cases of total paralysis with a flail foot in which paralysis of the quadriceps femoris is present and extensive ankle motion is undesirable. For the reasons above detailed, and especially with the object of avoiding the removal of the astragalus, it was thought that the object desired might be accomplished by making a transverse horizontal section of the foot below the malleoli and then pushing the foot back and the leg forward. For this purpose the following operation of transverse horizontal section was done. An incision is made on the outer side of the foot about 2 inches long, extending from the posterior edge of the external malleolus forward; it lies close to its tip. The long and short peroneal tendons then come into view and if it is desired to transplant them into the os calcis they are cut long and turned out of the way. If it is desired to preserve them intact, they can be loosened from their sheaths and held aside. Through this incision, with a chisel and periosteal elevator, the soft structures are raised from the bones anteriorly and posteriorly. Then a transverse horizontal section of the bone is made in the line of the skin incision, but passing entirely through the tarsus from the junction of the os calcis and astragalus posteriorly and emerging on the anterior surface of the cuneiform bones. In making this bone section, no attention is to be paid to the joints. It passes through the subastragaloid joint cutting off parts of the upper portion of the os calcis and lower portion of the astragalus; it may clip off a piece of the upper portion of the cuboid, the scaphoid and the upper portion of the cuneiform bones. These pieces may or may not be removed. As it is too difficult to loosen the foot sufficiently through this incision another about 1 inch long is made on the inner side of the foot below the internal malleolus and over the sustentaculum tali. The tendon of the tibialis posterior is exposed and loosened from its sheath and held out of the way. The soft parts having been loosened from the bones anteriorly and posteriorly the bone section is completed from the inner side. An effort is then to be made to push the foot back and the leg forward. If this cannot be done then with a chisel or other instrument the soft parts are loosened still more until the foot can be displaced as far backward as is desired. Any loose pieces of cartilage or bone that may present in the incision can be removed. If desired, the peroneal tendons can now be implanted into the os calcis, the external incision being prolonged backward or a posterior incision added if necessary. To hold the foot in its new position chromic gut sutures may be passed from the tibia and fibula above to the tarsal bones below. The wounds are to be closed without drainage, and the foot put up in plaster of Paris. A wooden sole plate is to be incorporated with the plaster and it is to be placed in a position of slight varus and equinus. While the plaster is setting, the foot is to be pressed firmly back and the leg bones forward as much as possible. If desired, at the end of a week or so, a window may be cut in the plaster and the wound inspected, or the plaster and dressing may be entirely renewed and this left on until eight weeks have elapsed. The plaster cast is then removed and a simple ankle brace substituted to keep the foot from everting under pressure. This may be worn for a few months until bony consolidation is complete to be followed by a suitable shoe.

The technic of all these operations on the tarsal bones is difficult and this is no exception. It is hard to make a complete horizontal section through even two openings and it is especially difficult to loosen the soft parts sufficiently to allow of the displacement of the foot backward. Even if the foot is displaced sufficiently far backward at the time of the operation, if the plaster cast is not very carefully applied the foot may again slip forward and only a partial success be achieved. This has occurred in some of my earlier cases. It is fortunate, however, that a satisfactory result is usually obtained even in those cases in which the displacement is not as great as had been desired. The shifting of the center of gravity and the obliteration of the subastragaloid joint and the increased stability and solidity of the foot produced by the operative traumatism all tend to a betterment of the previous condition and its accompanying disabilities. The operation has now been done on a considerable number of cases during the past two years and if one succeeds in having the foot heal primarily in a good position the ultimate results seem to be satisfactory. Additional experience is desirable before one can say at what age this operation should be done. The younger the patient the longer will it be necessary to use either a brace or special shoe to prevent the foot from everting. I am convinced that it is suitable for patients ten years of age and am disposed to think that it will prove successful even as low as seven years. At all events little bone has been removed and even if a subsequent valgus does develop it can readily be corrected by a second operation.

XVIII.

RECURRENT ANTERIOR DISLOCATION OF THE SHOULDER.*

BY JAMES K. YOUNG, M. D., PHILADELPHIA, PA.

Recurrent anterior dislocation of the shoulder-joint is a condition not infrequently encountered and is characterized by structural changes in the articulating surfaces or capsule of the joint; some of the conditions of etiological significance tending to this recurrence include:

(1) A very large laceration of the capsule most usually located in the anterior or internal aspect, allowing the escape of the head of the humerus from the glenoid cavity.

(2) A lax condition of the capsule proper or a free communication between the joint and the subscapular bursa.

(3) Fracture on the inner edge of the glenoid cavity, reducing the depth of the cavity.

(4) Atrophy of the musculature of the affected side.

(5) Rupture of the outward rotators of the humerus or avulsion of the greater tuberosity.

A marked characteristic symptom evidenced in this class of cases is impairment of function varying greatly in degree, up to those pronounced instances where complete disability is manifested and the patient may be prevented from following his usual vocation. Parenthetically, it may be remarked that occupation plays a dominant rôle relative to the frequency or infrequency of these recurrences; and that those vocations that demand continuous abduction of the arm, strongly predispose to a repetition of the condition.

As related above there are many factors attributed by different authorities for the production of recurrent anterior dislocation of the shoulder.

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* Presented at the Washington meeting of the American Orthopedic Association, May, 1913.

To attempt a discussion of the many theories proposed and defended as etiologically favoring these repeated luxations would be to inscribe a paper of voluminous proportions. Suffice it to record the view entertained by Joessel* who avers that at times the rotators may be torn off or avulsion of the great tuberosity occur, resulting in a marked lessening of the concentric stability of the joint surfaces during motion. He believes that the likelihood of recurrence of anterior shoulder dislocations is caused by the tearing off of the supraspinatus and infraspinatus muscles with the underlying capsule from the humerus and that another etiological factor favoring the condition is the constantly increasing size of the capsule.

Observation and experience would tend to confirm the statement that the recurrence of anterior shoulder luxutions is dependent upon a tear in the anterior and lower portions of the capsule, through which the head of the humerus has escaped and essentially due to abduction at the shoulder; and, furthermore, many investigators declare that the tear in the capsule is anterior and below and usually from the glenoid margin, the posterior part of the capsule remaining intact.

Following the primary dislocation there may be a period of weeks or months elapsing before a recurrence again takes place, when suddenly the arm is in a certain position, luxation again occurs. This may follow slight exertion, as merely turning over in bed. As a result of the condition there is muscular atrophy about the shoulder, with moderation in the limitation of motion.

In connection with these thoughts, a study of paramount importance presents itself, namely, the occurrence of perineuritis and neuritis associated with dislocations of the shoulder. Most investigators admit the theory of a radicular (roots of the plexus) paralysis most frequently due to injury about the shoulder and they divide the cases into those due to lesions of the roots of the plexus itself, and those due to lesions of the terminal branches of the plexus.

Infantile obstetrical palsy closely resembles the foregoing condition. Its etiology is to be found in the forced abduction of the arm, with or without traction upon it and the absence of traction on the head. Some years since,* I reported a case of disability in a child and invited attention to the frequency with which dislocation of the shoulder is confounded with birth palsy. At that time I emphasized the fact that if dislocation be allowed to continue it will result in the production of a pressure palsy resembling a birth palsy.

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* *Deut. Ztschr. f. Chir.*, 1880, 167.

With these very brief prefatory remarks, bearing on an all-important subject, I wish to relate the history of a patient recently referred to me by Dr. Robert L. Gray.

The patient, W. R., age twenty-four, artisan by occupation, offered the statement of much suffering as a result of recurrent dislocation of the left shoulder-joint. He was a strong athletic man without any previous important history bearing on the condition except that he had sustained a traumatic dislocation of the shoulder-joint while engaged in playing a game of soccer. The recurrence took place when the arm was extended from the side of the body with the forearm and hand also extended. This luxation repeated itself several times a day, and was associated with pain, and interfered with the patient's pursuance of his regular occupation.

At this juncture, let me say that the operation for recurrent dislocation by pleating the capsule or other operation upon the capsule has in some instances been satisfactory in my hands. I am well aware that various procedures upon the capsule, capsulotomy, casulorrhaphy, etc., have been practised and recorded by Ricard of France in 1892 and antedating this, Gerster, of New York,† excised part of the capsule and sutured the edges of the opening together, and in 1886 Bardenheuer excised two portions of the capsule latterly. Burrell‡ and T. Turner Thomas emphasizes the wisdom of this procedure and yet I, personally, principally resort to this measure in cases of infantile spinal palsy in order to allow of greater relaxation of the part.

* *Annals of Surgery*, 1905, XLII, p. 777.
† *Medical News*, Phila., 1884, XLIV, p. 423.
‡ *American Journal of the Medical Sciences*, August, 1897.

I prefer an operation that was suggested to me by Dr. Oscar H. Allis, of Philadelphia, which appears to be mechanically correct and in this particular instance has resulted in perfect restoration of function. Since the dislocation occurred in the extended position it was proposed to divide the lower portions of the insertions of the pectoralis major and the latissimus dorsi muscles and by holding the arm in an extended position for two weeks to lengthen this portion of the tendon so that these muscles could not through the contraction of their lower portions produce the dislocation.

Such views emanating from Dr. Allis always command respect when one regards his classic work on dislocations of the hip experimentally studied on the cadaver, especially in reference to his elaborate deductions concerning the capsule of that articulation. Before I performed the operation on the young man's shoulder, Dr. Allis illustrated his *modus operandi* upon the cadaver and I performed it twice upon an emaciated subject in the dissecting-room, while another dissection, complete in every detail, was made upon a muscular subject through the kindness of Dr. Addinell Hewson, Professor of Anatomy at the Philadelphia Polyclinic. The operation is not difficult either upon the cadaver or upon the emaciated subject, but in a highly developed muscular person, it becomes more troublesome to divide both muscles through one incision.

Anatomy of the Shoulder-joint.—The shoulder-joint is the most movable and most perfect of the ball-and-socket joints; the almost spherical head of the humerus playing freely in the shallow glenoid cavity. The capsule that invests the articulation is loose and apparently insufficient; consists of two layers of fibers—one straight and the other oblique—intimately united and still further strengthened by a few interwoven circular fibers. The capsular ligament finds added support in the three accessory glenohumeral bands, namely, the so-called superior, middle and inferior. Projecting into the interior of the joint from the fore and inner part of the capsule are the above three bands, the most important of which is the superior or glenohumeral ligament, thin and ribbon-like, which arises from the margin of the glenoid cavity at the base of the coracoid process, internal to the origin of the long head of the biceps and passing downward and outward forms a groove for the biceps tendon and is inserted into a depression above the lesser tuberosity of the humerus. The capsule is further strengthened and supported by the tendons and of the suprascapularis, the teres minor and the supra- and infraspinatus muscles. Below it is strengthened and supported by the long head of the triceps, receiving a filament from the pectoralis major muscle.

It is interesting to note the extreme looseness of the capsule; it is much larger and longer than is at all necessary to keep the bones in contact, allowing them to be separated from each other more than 1 inch. According to Joessel the normal capsule will accommodate 28 c.c. of mecury, but in some specimens in which he supports his theory of tearing of the rotators, etc., some capsules accommodated as much as 90 c.c. The coracohumeral or accessory ligament is a board band which strengthens the upper part of the capsule. Arising from the outer border of the coracoid process and passing downward and outward to the front of the great tuberosity of the humerus, some of its fibers become blended with the tendon of the supraspinatus muscle.

The narrow rim of the glenoid socket is surrounded and deepened by a band of dense fibro-catilage, the glenoid ligament which at its upper part is strengthened by the prolonged fibers of the biceps tendon; the socket in the scapula is very shallow, but is much deepend by the above glenoid ligament. It is small in size compared with the large articular surface of the head of the humerus and this disparity gives greater freedom of movement with lessened security and more liability to displacements in extreme movements. The glenoid ligament is covered by synovial membrane which lines the capsule and is attached to the humerus as far as the edge of the articular cartilage. The synovial membrane extends along the tendon of the biceps and communicates with the bursa of the subscapularis muscle and occasionally with the bursa beneath the infraspinatus.

Muscles of the Shoulder-joint.—Shoulder movements are accomplished by a large number of powerful muscles. These muscles are usually described in two groups.

The *dorsal* group includes the deltoid, teres minor, infra- and supraspinatus, latissimus dorsi, teres major and the subscapularis.

The *ventral* group includes the pectoralis major and minor and the subclavius.

Muscles most concerned in recurrent dislocation are the pectoralis major, latissimus dorsi and the teres major latissimus dorsi is inserted into the bicipital groove. Pectoratis major is attached to the posterior bicipital ridge. Teres major is inserted into the crest of the small tubercle of the humerus.

The pectoralis major is inserted lower down on the humerus than the latissimus dorsi, which gives it a greater leverage. The insertions of both these muscles are covered by the inner portion of the deltoid, separated by the long tendon of the biceps. In recurrent dislocation of the shoulder where the dislocation occurs with the arm in the extended position, as in my case related above, it is obvious if the lower half of the insertion of the pectoralis major and latissimus dorsi are divided and prevented from uniting, the powerful upward leverage of the muscles in producing dislocation of the shoulder will be overcome. This is the object sought in the operation performed. In the dissection of the shoulder-joint it is found easiest and most expedient to reach the bicipital groove and the attachment of these two muscles by making an incision directly over the groove, through the skin and superficial fascia and through the fibers of the deltoid muscle.

Author's Operation.—I first locate the pectoralis major muscle. A grooved director is placed beneath this muscle and its lower portion divided. The long tendon of the biceps may be displaced inward, and the broad flat tendon of the latissimus dorsi can be hooked up by the finger, or by some blunt instrument, such as an Allis' dissector; the insertion of the tendon is exposed and the lower half divided. No attention is paid to the capsular ligament.

Upon the cadaver the operation was performed in the manner already described, but in performing it upon the living subject, the bicipital groove was exposed by an incision over the space between the deltoid and pectoralis major muscles, and the caphalic vein was displaced outward. The pectoralis major and the deltoid muscles were brought together with deep catgut sutures. The skin was closed with a continuous suture and the arm dressed in an extended position upon a triangular splint and kept in that position for a period of two weeks. Following the operation, and upon the recovery of the patient, there was no loss of power over this shoulder as compared with its fellow, nor has there been a recurrence, although the man has again resumed his occupation and has taken part in several games of soccer since.

XIX.

MECHANICAL TREATMENT OF SOME FRACTURES, VIZ., (1) LOWER END OF THE HUMERUS; (2) BOTH BONES OF THE LEG.*

BY FRANK E. PECKHAM, M. D., PROVIDENCE, R. I.

During the past year or so many articles have appeared regarding the treatment of fractures and the majority of them have advocated the open (operation) method. It is only recently that words of caution have appeared against such procedures. Then, later, writers have begun to call attention to the great danger from sepsis when metallic plates are used and Dr. John B. Roberts in the *Annals of Surgery* for April, 1913, reminds us that these plates retard union, and then cites seven deaths from plating the femoral shafts. Apparently, the pendulum has begun to swing back again and ultimately fewer fractures will be operated, because surgeons of mechanical ability will be able not only to obtain a fairly accurate reduction but to display sufficient mechanical ingenuity to hold the reduction, often in the face of great difficulties.

I have noticed that some writers have advocated the use of pins in fractures of the lower end of the humerus. A number of such cases have presented, and two or three of the difficult ones will be illustrated.

CASE I.—M. H., age two years. The lower end of the humerus was fractured September 3, 1912. It was diagnosed (without X-ray) as a dislocation, and a supposed reduction made. An X-ray showed a fracture. This was reduced on September 9, and proved by the X-ray, the arm being in acute flexion. Another picture on the twelfth showed that the fragment was knocked off, and on the thirteenth, under ether (for the third time), reduction was again attempted. It was with great difficulty that the fragment was so placed that it was really fixed in position and practically an hour was consumed in accomplishing the result. An X-ray was taken after each attempt, so that the knowledge regarding the position was positive. After this setting, there was no further trouble. Motion was begun at the end of the third week and the arm then baked and manipulated three times weekly until full function was restored.

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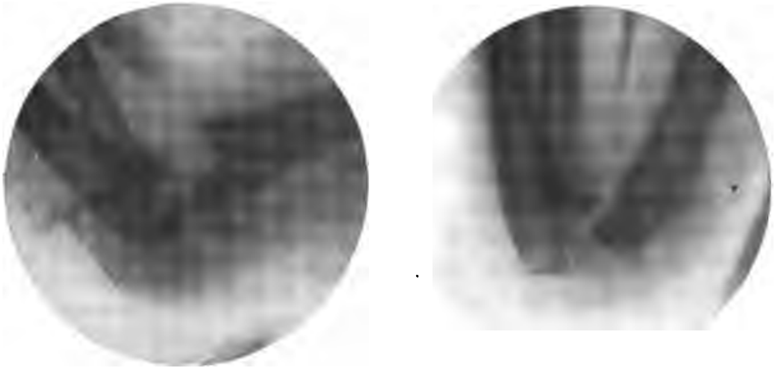
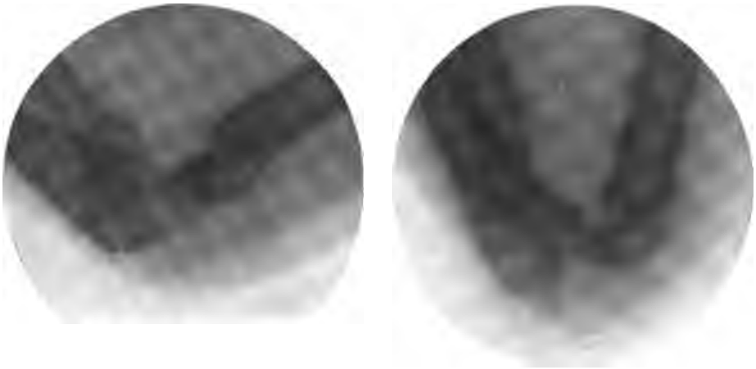
* Read before the American Orthopedic Association, May, 1913.



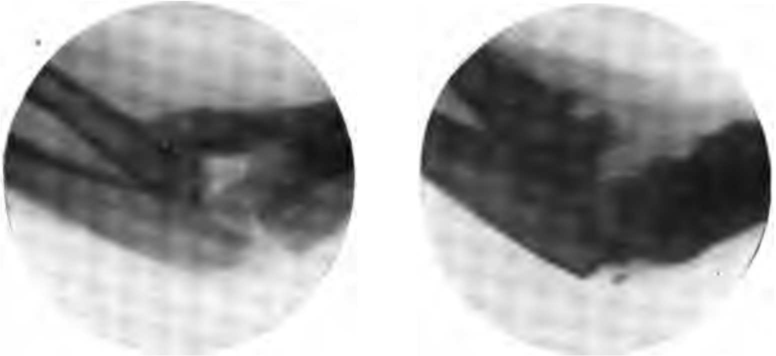
Case I.—Showing fracture of lower end of humerus and its final setting on the tenth day after injury.



Case II.—Showing fracture of lower end of humerus and its final setting two weeks after the injury.

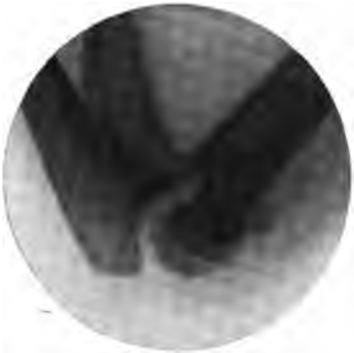
Case II.—T. G., age four years. The lower end of the humerus was fractured September 9, 1912, and set on the tenth, being proved up immediately by an X-ray picture. This arm was also put up in acute flexion. A few days later it became displaced. I waited here until exactly two weeks from the fracture, then under ether on September 23, reduction was made, and again it was with some difficulty that the fragment was really fixed in position, when it was again proved by an X-ray picture. Motion was begun in the fourth week and baking and manipulation three times weekly until full restoration of function.

CASE III.—A young boy fractured the lower end of the humerus and was treated by some kind of splinting for a month, but on account of a stiff elbow, was brought to me about nine weeks from the date of the fracture. The X-ray picture shows a bone bridge which, as you see, completely locks the joint, thus preventing all motion. The bridge was removed by an open operation, but a slight projection grew again, and there are only a few degrees of motion. The mother is considering another operation.



CASE III.—Showing a fracture with a bone bridge locking the joint and also its present condition after operation.

CASE IV.—A failure. This was a fracture of the lower end of the humerus in a girl eight years of age. I was unable to hold this fracture in position either by a splint or in acute flexion, so at the end of the second week bed treatment was instituted with extension and counter-extension (Bardenheuer). The fragments, as usual with this method of treatment, came into perfect position. After two or three days in bed, a slight abrasion of the skin in the flexure of the elbow become infected and apparently the whole joint became involved. Wet dressings were applied without sacrificing the position of the arm at all. There was no suppuration and everything quieted down with the fragments still in perfect position, as proved by the X-ray. Toward the end of the fifth week from the fracture and the third in bed, everything apparently being all right, the patient was allowed up with arm in a sling. It proved too soon, for the fragment slowly slipped back into its deformed position, showing me that the inflammation had interfered with union, and in a similar case, traction treatment would be continued longer.



Case V.—Showing result of incomplete reduction.

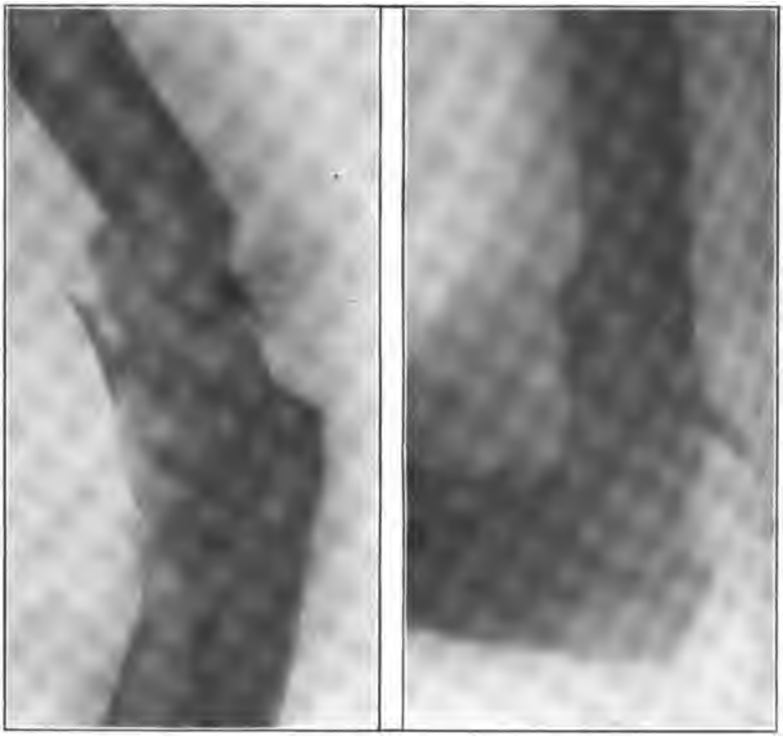
Case V.—This case came under my observation because complete flexion was lacking and the X-ray shows the mechanical reason. Two points impinge when the arm is sufficiently flexed. This demonstrates why in this fracture the reduction should be perfect.

Case VI.—This was a fracture of the lower end of the humerus in an adult, that many surgeons would "jump at" to plate as far as can be judged from the literature, yet after two or three attempts the reduction was obtained as shown in the X-ray picture.

In this fracture, I feel that the reduction should be as absolutely perfect as possible and by this is not meant clinically but as proved to be so by the X-ray.

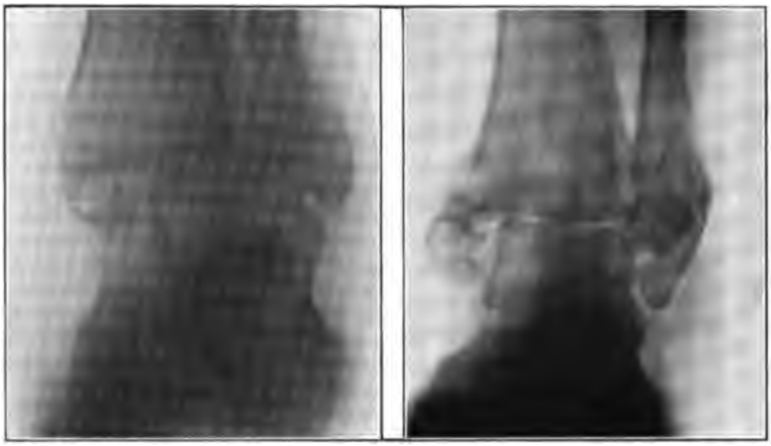
Passing now to fractures of both bones of the leg.

Case VII was that of an adult woman who, ever since the accident two years before coming to me, had walked by the use of crutches and swinging the effected leg because any weight bearing caused pain. The X-ray had been seen by a goodly number of surgeons, all of whom had nothing to offer. A study of the picture shows that both malleoli are fractured and that the foot is displaced laterally outward. In addition, there was a small spicule which does not show in the print but which appeared in the negative, sticking down into the astragalus, causing pain on weight bearing. An operation was done, removing the spicule, then an osteotomy of each malleolus and pushing the foot laterally inward into its proper position. It was then encased in plaster of Paris. Suppuration took place, but notwithstanding this, the foot was held fairly well on a posterior wire splint, and at the end of eight weeks this patient walked down stairs for the first time. The foot was then baked and manipulated for a number of weeks when motion in flexion and extension was fairly good. She is walking on the foot all right now, and the X-ray shows the permanent result. This in spite of suppuration.

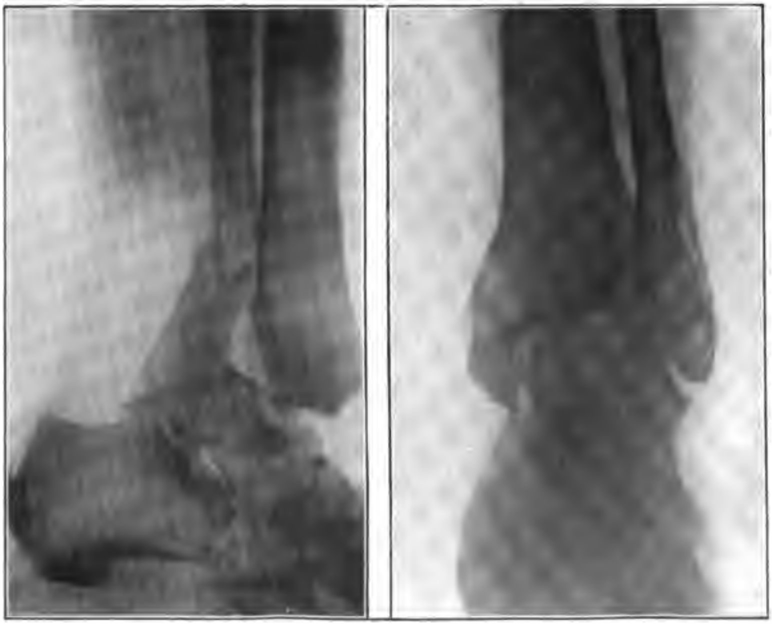


Case VI.—Showing fracture of lower end of humerus in an adult. Held on an internal right-angled tin splint.

Case VIII.—This fracture came in while Case VII was already under treatment. Here was a fracture of both malleoli with backward dislocation of foot and fragments. Many



CASE VII.—Showing the original condition, while the second picture shows the condition one year after operation.



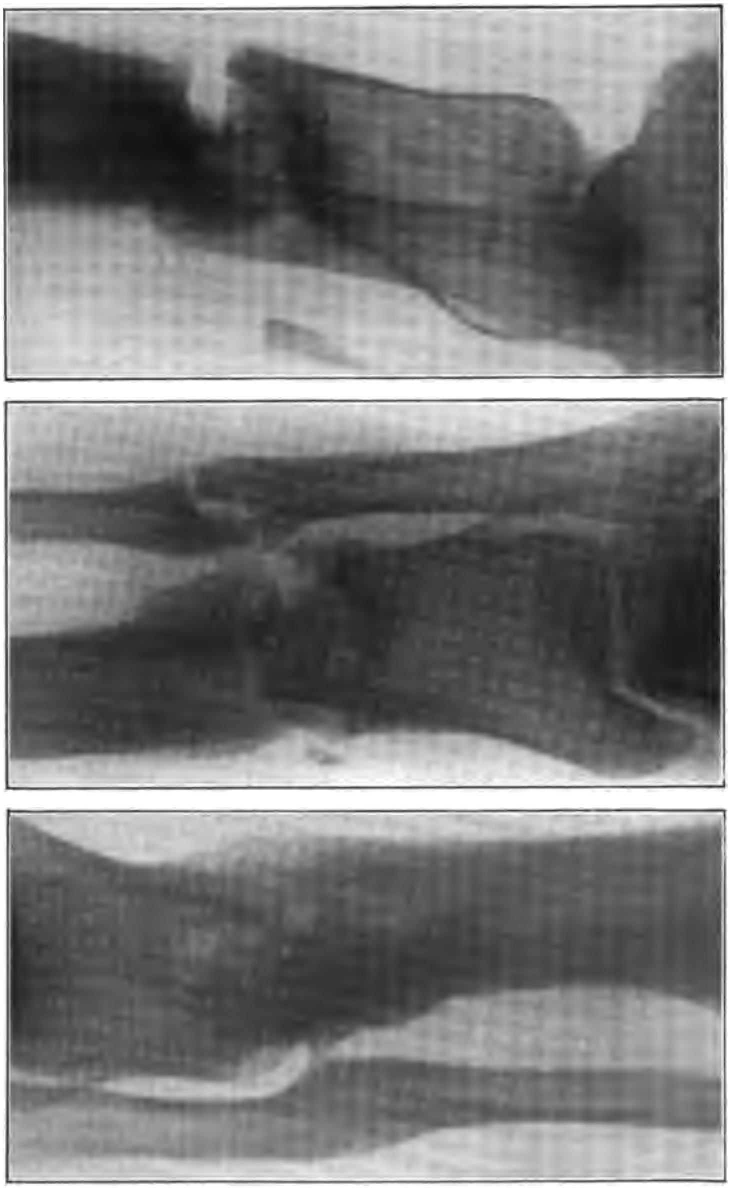
CASE VIII.—Fracture of both mallcoli with backward dislocation of foot and fragments, and the condition one year later.

things have been mentioned in connection with the treatment of this condition, including plates, pins, and even removal of the astragalus, but with the patient under ether, it was not so very difficult to reduce and put in plaster of Paris. It was proved by the X-ray and the second picture here shows the condition one year after the injury. The motion in flexion and extension is normal, the lateral motion only slightly limited.

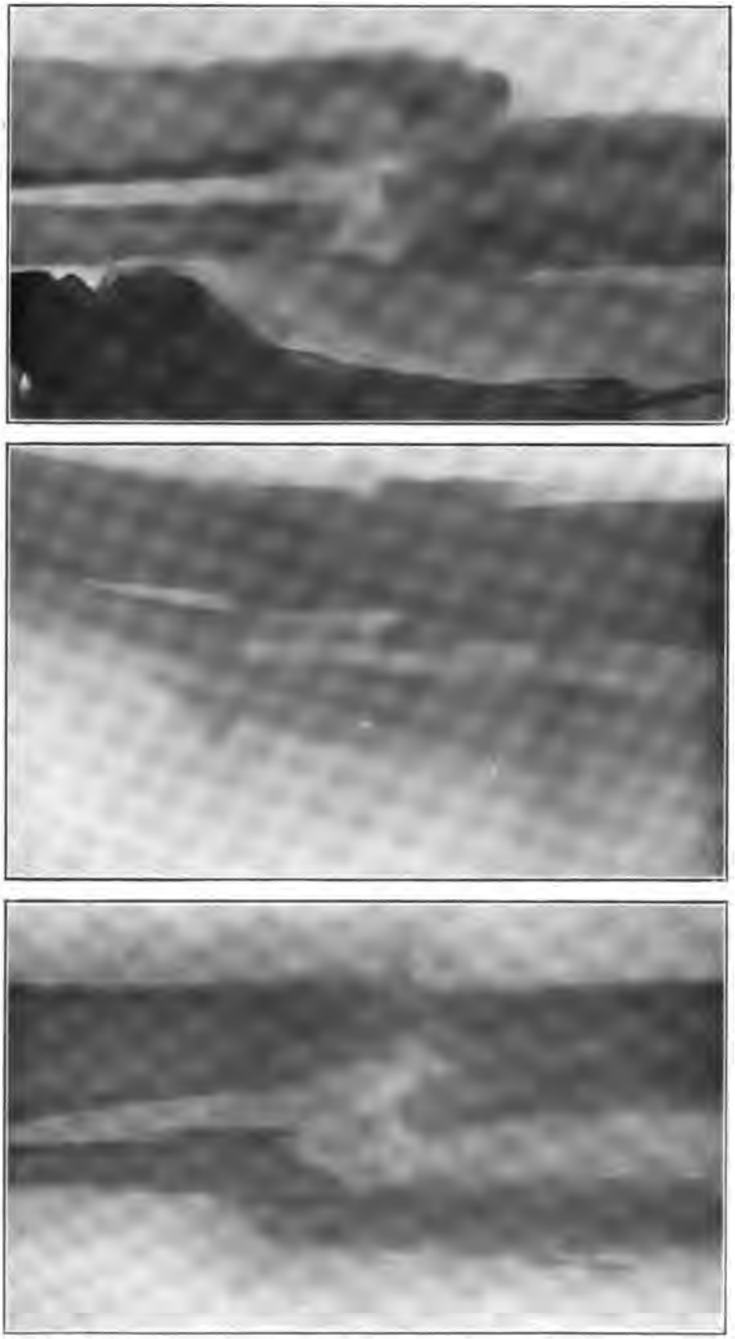
Case IX.—This was a fracture of both bones of the leg, which occurred December 20, 1908. When I first saw the patient, October, 1910, there had been four operations for ununited fracture, and amputation had been advised. On October 20, 1910, the crest of the tibsa was used as a bone graft, placed in a groove which had been chiseled out for it. This graft slowly melted but simultaneously; bony union took place, and in June, 1911, full weight bearing was an unconscious performance. When weight bearing began the union of the fibula took care of itself.

Case X.—This was a compound comminuted fracture of both bones of the leg. There were a number of weeks of suppuration when the position of the fragments was disregarded except that the whole leg and foot were held on a posterior wire splint covered with rubber so that continuous irrigation could be carried out. Fragments were removed two or three different times and finally the time came to attempt to get the bones lined up. Even Lane says do not use plates on a compound fracture. With an open wound still existing, the tibial fragments were placed end to end, and the fibula overlapping as shown in X-ray picture. A tight-fitting plaster cast was then applied with a window at the wound for dressing. The final picture shows that the position was pretty well retained and also shows the calcification.

In order to hold fractures of the leg in position for the application of plaster of Paris, a small frame like the Bradford frame is used. This frame is somewhat wider than the leg, so as to allow plenty of room for winding the plaster bandages around. At the end, under the buttock, an upright is located and well padded, which rests against the perineum where traction is applied. At the end of the frame beyond the foot is a windlass arrangement to which the extension straps are attached. Then two or three cross straps are passed, upon which the leg rests. Traction is then applied, the fragments arranged by the operator,

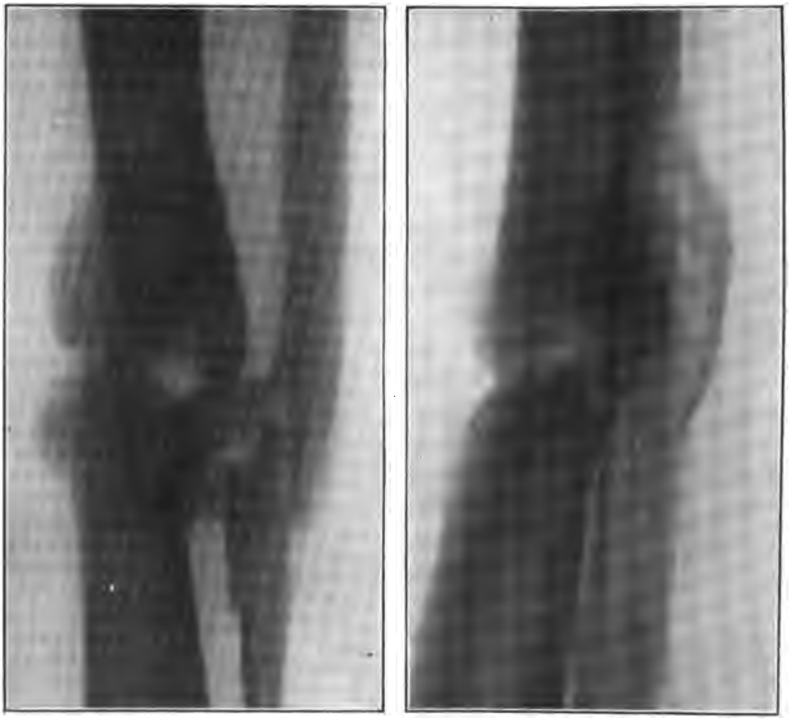


Case IX.—Fracture of both bones of the leg, treated nearly two years after the accident by bone grafting.



CASE X.—The first and second pictures are the fractures, while the third one shows how it looked after setting.

both hands being at liberty to do this work, and then the whole leg and foot are encased in plaster of Paris. The plaster is then bivalved, cutting nearly, but not quite through, so that the upper half of the cast may be removed as soon as agreeable to the operator, the posterior half being retained as a splint for the completion of the treatment.



Case X.—About four months after the injury.

In the treatment of fractures, it is absolutely essential to make a complete use of the X-rays. In the first place, it is necessary to know the exact condition mechanically in any fracture as only an X-ray can tell it. Then when it is to be set, to my mind, the patient must be near an X-ray machine and after the work has been done, a picture should be taken immediately. If it is right, the proof is at hand, and if not, try again, and prove it again, and never stop until it *is* all right. Most fractures can be brought to the office, even if the ambulance is necessary, the work done, usually in a short time, and after full recovery from a short ether, the patient is easily returned home.

If for any reason it is desirable to do work in a patient's home, and at the bedside, Fig. Y shows a portable outfit, the storage battery being of great use in Providence and surrounding country, where there are several different electric currents in use. This storage-battery outfit is of great value also, in that it can be used in houses either in the city or country where there is no electric current.

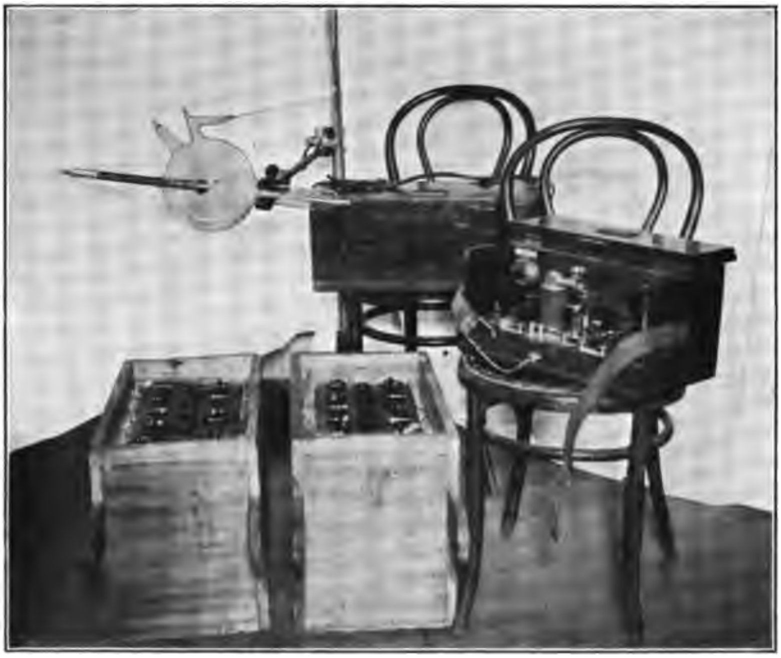


FIG. Y.—Portable X-ray outfit with storage battery. No street current of any kind necessary.

A recent case was that of a boy who fell out of a second-story window. He was injured in the spine at the level of the lower angle of the scapula. Here the tenderness on motion was too great to think of moving several miles to an X-ray machine. It was imperative to know at once whether there was a fractured spine. The portable X-ray outfit as shown in the photograph was placed at the bedside. The plates were developed immediately in a dark clothes closet and within a short space of time there was ocular proof that there was no fracture.

XX.

NEGLECTED INFANTILE PARALYSIS.*

BY WALLACE BLANCHARD, M. D., CHICAGO, ILLINOIS.

It is as evident that the prevention of deformity gives better results than corrected deformity as that "an ounce of prevention is worth a pound of cure." It is the universal experience of orthopedic surgeons that the great majority of acquired paralytic deformities they are called on to correct are the result of neglected infantile paralysis. In the majority of cases the neglect has not been because the people were too poor or too ignorant to secure good medical care, but because the physicians in charge were not familiar with the slow development and means of prevention of these deformities. Hexamethylenamine has been extensively used in the acute disease in the remote hope that because it is excreted to some extent into the cerebrospinal fluid it might possibly prove a remedy for the disease. The results have been disappointing. Various other drugs of no proven value together with massage and electricity are frequently used for months and even years, while the gradual oncoming deformity has not been observed or has received only passing notice.

The remarks of Dr. Bernard Sachs, a distinguished New York neurologist and chairman of a committee that investigated a New York epidemic of poliomyelitis, cannot be too often quoted. "I consider that the time given to massage and electricity in these cases is wasted; I cannot see that such methods do any definite good, and a great deal more benefit would be obtained by early institution of orthopedic measures."

It is fortunate that the cases are not very frequent in which both the arms and legs are useless and limp, with the abdominal muscles paralyzed.

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* Read before the American Orthopedic Association, May, 1913.

In most cases only one foot and leg are involved, and the most frequent deformity is with the foot in the equinovarus position, though it is sometimes in the valgus or calcaneus positions.

The excellent work of Professor Fritz Lange, of Munich, in tendon transference and lengthening for the restoration of muscle balance is generally acknowledged. He spends considerable time in personally testing each case and lays much stress on the electrical reaction of individual muscles.

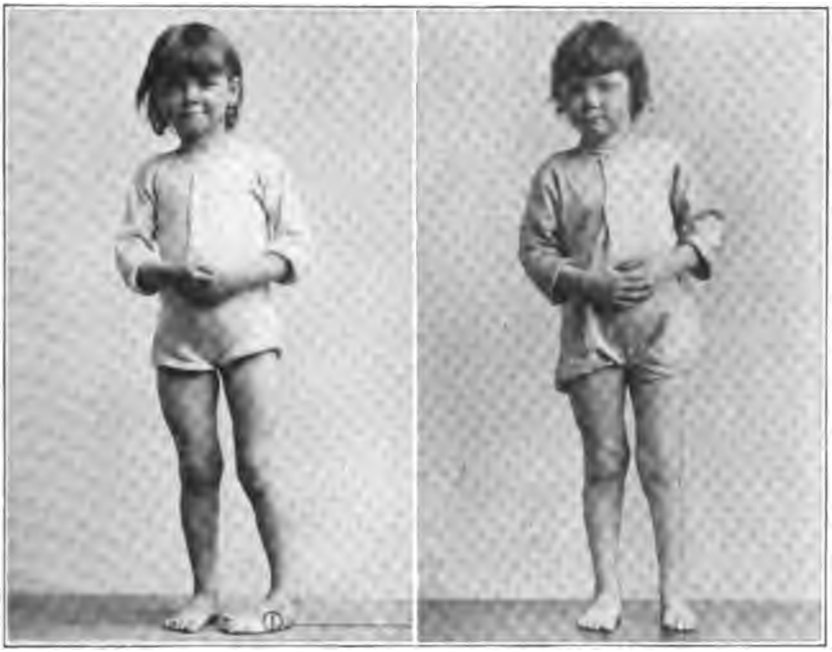

FIG. 1. FIG. 2.

The ultimate results of transferring the hamstrings to the quadratus tendon for paralysis of the rectus did not appear as good to me as his foot operations. The patients can stand on the well leg with the hip flexed and hold the operated leg extended forward, showing some little power of extension, but I did not see a case in which the knee did not flex under the body weight.

Professor Adolf Lorenz, of Vienna, speaks deprecatingly of Lange's work. He says that electrical reaction may be of some scientific value, but is of no practical significance. He says that he had seen very few cases in which tendon transplantation for paralytic foot deformity had been performed in which the correction could not have been better made and held by other means, and without the extensive mutilation.

Professor Lorenz told me he had attended a meeting at which Professor Lange had presented a number of cases of transplantation of the hamstrings for paralytic knee flexion and that in his opinion the results did not warrant the operation. In those cases in which the patient has good control of the leg except that he has to place the hand in front of the thigh to prevent flexion under body weight, Professor Lorenz does supracondyloid osteotomy and puts the leg in plaster of Paris, with the knee hyperextended. When the plaster is removed the patient walks with a back-locking knee-joint. Locomotion is thus made comparatively easy, if not exactly graceful.

Mr. Robert Jones, of Liverpool, does a skin shortening operation which he says he prefers to tendon grafting in many cases of paralytic club-foot. He removes a disc of skin the size of a silver half-dollar, or larger, and draws the skin together so as to make a pull in the desired direction.

I have selected photographs of one of my own cases of before and after correction of paralytic equinovarus (Figs. 1 and 2) on which to place a diagram of the operation. The circle represents the disc of skin removed and the perpendicular line the closed wound. The simplicity of this operation is one of its recommendations.

The skin-shortening holds good for about four months, when, in most cases, it gradually loosens up to a considerable extent.

Artificial silk tendon anchored at both ends in bone in cases where it can be used presents many advantages over tendon transference, for often when the best tendon in a partially paralyzed leg has been selected it may not be any too good.

Dr. Nathaniel Allison corrects the calcaneous position from paralysis of the calf muscles by artificial silk tendon carried from holes drilled in the os calcis, to be anchored well up in the shaft of the tibia. His results along this line are excellent.

Five- to ten-year-old children of poor people are frequently left at the Home for Destitute Crippled Children, Chicago, with a history of having had poliomyelitis at the first to third year, and of having laid helpless on the bed ever since. An examination frequently shows the hips and knees fixed in a position of extreme flexion and with the feet plantar flexed. In these cases we usually divide the tensor vagina femoris and every shortened strand that interferes with thigh extension. Then the hamstrings and the tendo-achillis are tenotomized. Next, the stretching machine is applied till the legs are on a line with the body, and the child is then put into plaster from the lower ribs to the toes. Frequently a month later the child will be found swinging himself between a pair of crutches around the ward, and later around the yard. After a time braces are applied in place of plaster. Thus a bed-ridden case becomes an ambulatory patient, with hope of still further improvement.

In cases in which the legs and thigh muscles are involved, and where knee flexion is a threatened deformity, we put the leg in plaster with the knee strongly hyperextended, so that if the rectus fails entirely the knee will take a back-lock sufficient to afford functional support. Nerve anastomosis is the ideal operation for the restoration of muscle equilibrium and we may see the day when it has passed the experimental stage.

Since it has been reported that Dr. Simon Flexner has identified the germ of acute poliomyelitis, it is reasonable to hope that a curative and prophylactic serum may soon be found.

Absolute rest in bed, with good nursing, is necessary in the acute stage. Later on, muscle training, massage, passive movement and electricity all have a place in restoring to weakened muscles their maximum of strength, but all these must be subservient to the prevention of deformity.

The general practitioner and the public should be awakened to the reality that it is necessary for the prevention of deformity that every case of infantile paralysis should be first and last under the care of the orthopedic surgeon.

This paper is composed of only a few desultory observations upon notes taken in passing. It is presented for the purpose of emphasizing the fact that the world over the orthopedic surgeons are devising newer and more improved ways of correcting deformities that might far better have been prevented.

DISCUSSION.

Dr. C. L. Starr, Toronto.—I think that it is due to my colleague, Dr. Gallie, to put on record the work that we are doing together, for which he is largely responsible. The difficulty that we found was that very frequently the strand of silk pulls out of its attachments; and Dr. Gallie suggested trying tying up the feet with the paralyzed tendon. Take a case of talipes, for instance. Instead of putting the silk in, as suggested by Dr. Allison, attaching the tendo-achillis to the heel, we slightly flex the foot to a right angle, and split the periosteum over the tibia sufficiently to place the tendo-achillis in it. Fastening it in there after putting the foot absolutely into a position of straight-foot does the business.

It seems to me that this holds out the possibility of correcting these conditions and getting over the disadvantages of the silk implantation. It is adapted to almost any type of paralytic condition. In varus, the peroneals can be removed from behind the tibia and the peroneus longus, or the peroneus brevis put into the gap behind the malleolus. If that is stitched into the fascia, it forms a firm bony attachment to hold the foot in good position. The procedure is equally applicable to any other situation on the foot.

As to the probability of the tendon's stretching, I would say that the tendo-achillis will not stretch, although the others may. I want to put this procedure on record, as it is a distinct advance, I think, in the treatment of that kind of case.

With regard to the knee, I would say that in doing back-locking to throw the knee back, I am sure that we all have had the experience of seeing the posterior ligament stretch and allow the knee to go too far back for locomotion purposes.

Dr. Walter Truslow, Brooklyn.—The title of this paper is "Neglected Infantile Paralysis"; and, to my mind, one of the joints that is most neglected and shows the worst results is the hip-joint. We all know that the contraction of those muscles whose origin is at the anterior superior spine of the ilium, and which cause flexion and abduction, is one of the most difficult things to deal with. The common procedure is tenotomy near the spine. I should like to state that the use of a long plaster-of-Paris dressing from the upper thigh to the toes acts automatically in overcoming these contractions of the hip flexors and abductors. It seems, by the weight of the plaster, to overcome the contractions, unless they are severe. If we then add the trolley apparatus, and get these children moving, we can complete the mechanical conditions necessary for recovery. Those overhead runways that wholesale butchers use are, comparatively speaking, inexpensive; and, with the Sayre head-spring apparatus attached to the wheel on this overhead trolley, passing through a harness, many children are greatly improved.

DR. E. G. ABBOTT, Portland.—As I gather from Dr. Blanchard's paper that he has come to the conclusion that muscle and tendon transplantation is of no value, as Lange considers, I wish to disagree with him entirely. I have made muscle transplantation in many hundreds of cases, and in the majority I have had success, particularly in connection with the foot. Many hundreds of patients who had never done so before in their lives abducted the foot afterward. A society lady in San Francisco, who had not walked for five years, was cured in this way. That girl danced at the Mardi Gras Ball, and it would be hard to convince her people that she had not been helped.

Regarding alteration of the joints, I would state that we have never had any trouble in getting proper alignment of the bones.

DR. R. E. SOULE, New York City.—Some time ago I published an article in relation to the joint in acquired valgus of the foot. Since then I have developed the operation which I have performed in the treatment of this condition and I believe that it is a very advantageous procedure. Where we have paralytic valgus of the foot, with loss of the entire tibialis posticus, we can restore the foot almost absolutely by anchoring the leg to the astragalus, which I have found in a large number of cases in which I have had my attention attracted remains in its normal relation to the tibia and fibula. It does not recur to the deformity first seen. It has a great value in restoring paralytic valgus. I have been able, by this method, to remove all supports or correcting apparatus and the patients have been able to walk about with a very slightly perceptible limp.

DR. B. E. MCKENZIE, Toronto.—Referring to the remarks made by Dr. Truslow a few moments ago, I would say that within the last six months or a year the most of the cases of infantile paralysis treated by us were of the kind mentioned by him, where there was a marked lordosis. In one of these cases, I thought that by the plan he spoke of, keeping the feet in position, the legs extended at the knees, using these as lever power, and keeping the child in training, the contraction of the muscles at the thigh and the tilt of the pelvis forward would be overcome. I found, however, that there was no further progress; so I made an extensive section of the muscles in the front by open incision, keeping the child recumbent with the lordosis fully corrected in plaster until the healing had occurred. In less than one month the girl volunteered the statement that she had made more progress in this time than in years previous. Since then, I have followed that practice exclusively, and have had good results. In cases in which there is extreme lordosis, when the patients are allowed to stay in a sitting posture, I do not think that you can have the best success possible without extensive section of the flexor muscles.

Dr. A. H. Freiberg, Cincinnati.—I am, I think, as optimistic as any man has a right to be regarding the effect of tendon transplantation for infantile paralysis; but I have come to the conclusion that we have been much too precipitate in our determination to operate in neglected cases of this disease. I make it a rule that we shall not decide to do a tendon transplantation in a neglected case, particularly of the lower extremity, until at least four to six months of patient mechanical and massage treatment have been gone through with; because our experience is that in this time we shall have a considerable gain in function, due to giving the muscles an opportunity for structurally shortening again. Mr. Robert Jones has called attention to this fact in different ways, and we all know it but this fact is lost sight of in concluding to operate on a case that has been paralyzed for a long enough time to make us think that a tendon transplantation is necessary. As the result of this treatment, we have often decided that such an operation was inadvisable in cases that at first had seemed to indicate tendon transplantation. We have seen function return to muscles that seemed at first to be entirely devoid of it. I do not think that I am by any means alone in coming to this conclusion; that if more men would adopt a plan such as this, many operations would be avoided and—what is much more important—many operations would be simplified because of our showing to ourselves the lack of any necessity to substitute others for muscles whose function is not lost, but is only in abeyance.

Dr. Wallace Blanchard, Chicago.—I merely called attention to the diverging views of Lange and Lorenz on the subject of tendon transplantation. I gave the views of the men, as I gathered them in their clinics, practically without comment, expecting that this would arouse considerable discussion at this time. The large number of neglected cases of infantile paralysis that are found in every clinic in this country cannot be too strongly emphasized, and we cannot be too strong in impressing upon the general profession and practitioners at large the fact that the deformities of infantile paralysis creep slowly forward and become fixed; and the prevention of these deformities by an early knowledge of the slow action of the shortening of the unparalyzed muscles and the lengthening of the paralyzed muscles should be urged. The orthopedic surgeon should be called in early, and the prevention of these deformities will be a matter that will be accomplished.

XXI.

HELIOTHERAPY (OF ROLLIER) AS AN ADJUNCT IN THE TREATMENT OF BONE DISEASE.*

BY ROLAND HAMMOND, M. D., PROVIDENCE, R. I.

The use of the sun's rays in the treatment of disease is nearly as old as the science of medicine. For many years surgeons have exposed sinuses resulting from bone disease to the beneficent action of sunlight, and have noticed an appreciable diminution in the amount of discharge from the sinuses, associated with an improvement in the general condition of the patient. The writings of Willard(1) and McKenzie and Galloway(2) in this field are well known to the members of this Association.

Artificial light(3) has been used to replace sunlight in many instances with good results, and sunlight has also been concentrated(4) by the use of planoconvex lenses, photographic filters and cooling solutions for absorbing the actinic rays.

Rollier of Leysin, Switzerland, has approached the subject from a somewhat different point of view. His method is to expose the entire body as well as the diseased area to a tanning process with the idea of stimulating all the recuperative powers of the individual. About ten years ago he became interested in the results of Bernhardt(5) of Samaden in the treatment of sluggish wounds by solar radiation. Stimulated by this work, Rollier began in a small way the treatment of surgical tuberculosis until now he has evolved a method of which he is master, and which bids fair to make him renowned in the rôle of those who have contributed to the fight against tuberculosis. His work is conducted in three sanatoria at 1250, 1350 and 1500 meters above sea-level.

The body is exposed in various parts to the sun until a uniform tanning is produced, after which the exposure is prolonged and the "full bath" given. The technic is as follows: A localized area, usually including the site of the disease, is first exposed to accustom the patient to the sun's rays. Then the feet are exposed for three intervals of five minutes each. On the second day the feet are exposed for three intervals of ten minutes each, and also the legs up to the knees for three intervals of five minutes each. On the third day each exposure of the feet is of fifteen minutes' duration, the legs ten minutes and the thighs five minutes. On the fourth day the arms are exposed, on the fifth day the back, on the sixth the abdomen, and on the seventh the chest.* On each succeeding day the exposure of all parts treated is made five minutes longer. The head is protected from the sun by a linen hat or small umbrella. As soon as the skin has become pigmented and the body immunized to the heat rays, the patients are kept from three to seven hours exposed naked to its influence. It is better to keep a cool wind from blowing across the naked bodies, since it mitigates the influence of the sun, although a sharper pigmentation is produced.

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* Read before the American Orthopedic Association, May, 1913.

The physical basis on which this treatment rests has been thoroughly worked out, and is of enough interest to warrant its presentation. Many years ago Downes and Blunt(6) showed that the red and yellow end of the spectrum possessed marked bactericidal properties, while the ultra-violet rays, which are easily absorbed, produced an intense hyperemia, resulting later in the pigmentation. Finsen,(7) Jansen(8) and others showed that the death of the bacteria could not be ascribed entirely to the light, but to the inflammatory reaction set up in the tissues by the insolation. Rollier and M. Rosselet, (9) a physicist, have conducted experiments on the absorption by the atmosphere of radiations of different wave lengths, taking into account the temperature of the sun and the absorptive power of the different gases composing the atmosphere. The width of the solar spectrum has been found to be slightly greater in winter than in summer for the same height of the sun. The intensity of the radiations of short wave length is greater at a high altitude than at a low level, and reaches its maximum in winter, tending to diminish as summer approaches. They also assert that the ultra-violet rays bring about a reaction by the production of pigment, and play a protective rôle. Rosselet has called the pigment a "transformator."

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*The back as well as the front of the body is exposed to the sun.

Rollier insists upon three requisites for his treatment: unusual absence of wind, intense solar radiation obtained only at a high altitude, and great purity of air. These conditions are admirably fulfilled at Leysin. His work has created much interest in Europe and to a lesser extent in this country. Many physicians have made the pilgrimage to the Lake Geneva country, and have gone home to write of it. De Quervain(10) describes the working out of the method. Witmer(11) details the results of treatment in tubercular diseases of joints, glands, peritoneum and urogenital apparatus, while Franzoni(12) was impressed with its value in cases with sequestra. Bardenheuer,(13) Armand-Delille,(14) Jerusalem,(15) Zadro(16) and others have confirmed these results. Straube,(17) who was a patient for many months at one of the sanatoria, adds a personal note in her enthusiastic description of the work. In his latest article, Rollier(18) reviews his experience with 650 cases of surgical tuberculosis under his care since 1903. Of 450 cases of closed tuberculosis, 393 were cured, 41 improved, 11 were stationary and five died. Of 200 cases with open tuberculous lesion, 137 were cured, 29 improved, 14 were stationary and 20 died. Six cases only relapsed.

Not all writers are so enthusiastic however. Spitzmüller and Peterka,(19) working in upper Austria, are unable to detect any marked influence from sunlight alone. Poncet and Leriche (20) believe that the method is applicable to nearly every climate and that all forms of inflammatory tuberculosis do better at the seashore, while deep-seated bone lesions and pulmonary cases are better treated in the mountains. Richard and Felten-Stolzenberg(21) have found that the results of heliotherapy in surgical tuberculosis are better at the seashore, and that the duration of treatment is shorter than at an inland location. Thus it will be seen that while a high altitude has been insisted upon by Rollier and many of his followers, a number of workers have obtained as good or better results at the seashore.

In Rhode Island we had only a sea-level hospital, situated in the country on the shores of Narragansett Bay, sixteen miles from Providence. Fogs are common here for a part of the day at least, and the wind is often sharp. Nevertheless, in spite of some discouraging features, we decided to give the treatment a good trial. After a short trial during the season of 1911, we began last summer a thorough testing out of the all-over sun bath in all cases of bone disease. A large platform was erected onto which patients in carts could be wheeled. Screens protected the patients from the wind, and Japanese sunshades covered the heads. As we were anxious to avoid the uncomfortable effects of sunburn, we consumed more time in producing the tanning than will be necessary in the future. The results have been good enough to warrant adding this treatment to the curriculum.

In order to determine if heliotherapy gave any results which were not obtained from the out-door life, good food and sea-bathing which had been employed at the Crawford Allen Hospital, I compared the statistics of the seasons of 1911 and 1912. During 1911 and full sun bath was used for a few weeks only, while in 1912 it was utilized every pleasant day for four months.

	1911.	1912.
Total number treated	70	60
Weeks of sea-bathing (five days a week)	14	13
Average age of patients (years)	7.4	6.8
Average gain in weight (pounds)	3.0	4.2
Gain in hemoglobin	0.8%	17.0%

There is a decided improvement in the figures of the season of 1912 over those of 1911, not only in gain in weight, but more noticeably in the marked gain in hemoglobin. There is also a clinical improvement which cannot be reduced to statistical data—an intangible thing which we can estimate only by observing the patient from week to week and month to month. In our cases the condition of the patients at the end of the season was much better than in previous years, and the sinuses which still persisted were healthier looking. Many of these have healed during the winter. The patients are in better condition this spring after a winter in the city, than in other years at this season. I have preferred to give the average results of the entire number of cases treated, rather than to select individuals showing the value of the treatment.

Conclusions.—Heliotherapy has a marked value in the treatment of bone disease, by stimulating the recuperative powers of the patient and shortening the course of the disease. It can be used at the seashore as well as at a high altitude. Sinuses tend to close quicker with its use, then without sun treatment. Combined with sea-bathing it forms a valuable addition to our treatment of these cases.

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Forbes and Copeland: *N. Y. Med. Jour.*, Nov. 16, 1912, XCVI, 1001.

DISCUSSION.

Dr. B. E. McKenzie, Toronto.—Dr. Hammond has brought before us a very important subject, and I must disarm criticism of anything that I may say by indicating that the statements that I have to make are not accurate in percentages, as those were that were made by Dr. Hammond. However, I have a comparatively large experience. Twelve or thirteen years ago, owing to conditions which I need not now describe, we were compelled to place our patients out of doors much of the time; and, incidentally, our attention was called to the advantages of this out-door treatment. Noticing these, we have extended the work and it has become a routine practice for a number of years. Beck, of fame in connection with the bismuth injections, wrote to me, as to all the other members of the Association, and sent me a blank form, asking me to state what number of sinuses, etc., I had found, and what was the method of treatment used; also what was the success obtained in such cases with his method. In reply, I said that I had little or no experience with it, because I had few opportunities to use it. I seldom see a tubercular sinus.

We do not take so long a time to expose our patients to the sun. Perhaps it is because the sun's rays are not so intense that we do not have to guard the patients so carefully from them as Rollier has to do in the northern part of Italy or the south of Switzerland or France. We have not usually exposed the entire body of the patient. That would probably be better. We have, however, exposed a large area, which was not limited to the vicinity of the diseased part. In disease of the spine, we have had the patients lie on the face; in hip disease, alternately on the face and back. We give rest with the Bradford frame, on which the patients are kept for months, without permission to sit up or make any change in their position. They are also well cared for in every other way. I had intended, two years ago, to compile the statistics that I had on the subject; but my tendency to postpone has prevented my doing so. I have a conviction, however, that if I were to say that the time of treatment essential for the cure of tuberculous joint disease is reduced 50 per cent. by the method followed in Toronto, I should not be much out of the way. The number of abscesses is reduced. A girl with large abscess of the head of the femur had it completely disappear. She was thirteen years old, and had a history of its presence for several years; and it may have been there some time before it was recognized. I thought that this collection must be opened; but it was injected with iodoform, and the girl kept in the manner that I have described, and within two months the abscess had entirely disappeared. Some may say that such an occurrence is not uncommon; but I think that it is, in the conditions just named. The patient was kept out of doors, and the abscess was never opened. I seldom open a tubercular abscess; and they do not open themselves, if we have an opportunity to employ this method of treatment.

When I was a lad my father's farm lay to the north of another farm which was not cleared of woods until I became a man. There was a strip of land two or three rods in width immediately to the north of a dense wood on this farm. Whatever was sown on that strip of land never came to maturity, and this fact has impressed me. This land got the sunlight in the morning and afternoon, and it was out of doors; but the hot sunlight necessary for the complete fruition of the vegetable products never reached it. I believe that this is also essential for the development of human beings.

Dr. Roland Hammond, Providence.—I simply want to impress upon you the fact that I think this method is a distinct advance; in that Rollier's theory is to expose the whole body, in addition to the sinuses. We have been thus treating the sinuses for many years; but, according to his theory, we should expose the whole body. We have done so, and consider it a distinct advance.

XXII.

THE VALUE OF EXHAUSTIVE CRITICAL STUDIES AND GENERALIZATIONS IN CHRONIC JOINT DISEASES, WITH ILLUSTRATIONS OF THEIR USEFULNESS IN CONCEPTIONS OF GOUT, INTESTINAL TOXEMIC, ATROPHIC AND HYPERTROPHIC ARTHRITIS.

BY H. W. MARSHALL, BOSTON, MASS.

Scientists may discover facts and laws of scientific subjects, as in physics, physiology, chemistry and biology without thought of practical applications. Secondly, some persons utilize discoveries of others to develop practical ideas by thorough studies, but without contributing anything else new except unusually practical notions. Thirdly, many physicians combine their treatments of patients with attempts at making new scientific discoveries in laboratories. And lastly, the remainder simply employ the results obtained by members of the other groups.

All are concerned more or less in medical progress, and the efforts of practical individuals mentioned in the second class will be considered especially in this paper.

The advantages and disadvantages of this method of study are numerous. Most serious disadvantages arise from judgments which are formed naturally by general practitioners, practicing specialists and pure scientists, and misapprehensions need to be pointed out and explained.

General practitioners criticize results as being too theoretical for actual uses. Specialists are so absorbed in their own particular departments of medicine that they tend to overlook the value of generalities. And some pure scientists cannot see as great merit in merely practical endeavors as in striking new scientific discoveries.

On the other hand, such studies lead to the relief of very many patients who cannot be relieved by any other methods; because generalizations secure adoption of comprehensive physiological methods, and these are successful when special incomplete ones fail. Secondly, exhaustive critical studies lead to better understanding of various obscure types of arthritis, and indicate most profitable lines for further experimental studies.

The writer, having had experience with these methods, wishes to explain their value, and to discuss conclusions of persons who imagine that such integrations and digests are too theoretical to be useful.

From a few so-called theoretical ideas which he has arrived at by personal study it will be shown that the ideas are not unsupported theories, as they are first thought to be, but useful, unusual combinations of facts.

The discussion must be complete to be convincing, and will be taken up under the following heads.

1. Logical justifications for the method.
2. Actual results of study.
3. Practical uses of these results of exhaustive critical studies.

Logical Justifications for the Method.—Everyone will grant that a person, properly qualified by preliminary training, who spends his time solely in examination and treatment of patients, with thoughtful consideration of clinical data collected from them and with frequent references to scientific literature, will reach different conclusions from those he would arrive at if he spent his energies, when not occupied with patients, wholly in special laboratory experiments.

These opinions will be different also from those a person will reach who spends his time wholly in the routine of busy practice, accepting conclusions of others necessarily from lack of time, without attempting to contribute new practical points of view by original studies himself.

It is to be expected the mental wanderings of a practical person in search of new ideas will cover a wider range of topics, and touch upon many useless and perhaps some profitable ones, much as a person solves a difficult mathematical problem only after many fruitless trials.

Perhaps it will be seen also that many obscurities in medicine are due to lack of comprehension of unusual combinations which exist, rather than to lack of knowledge of the main facts and principles which form them; and that solution of some medical problems, as well as mathematical ones, depends solely in puzzling out complex arrangements of well-known ideas.

With chronic joint diseases it happens there is great confusion regarding their etiology, classification and treatment, and the question arises whether better understanding of them will come through more clinical and laboratory studies or through critical attention to facts which are known. The right answer probably is that both methods will yield some new ideas, that digests and generalizations now will point out more explanations for obscurities than special experimental studies alone; and that under present conditions probably unknown specific causes are being sought which really do not exist.

Whatever the belief of readers may be concerning these last statements, it will be admitted that there is no reason to assume that facts, which are being established in all the scientific laboratories of the world, will rearrange themselves spontaneously in particular ways best adapted to clear up especially obscure medical problems. The latter must be worked over tediously like mathematical data, tried out and tested until the right arrangements are discovered which tally with clinical data.

Actual Results of Study.—A beginning will be made with the following topics: (1) Influence upon the composition of the blood of absorptions from the digestive canal combined with excretions by the excretory organs. (2) Factors that determine beneficial and deleterious influences of constituents in the blood stream. (3) Significance of waste products of harmless intestinal bacteria. (4) Variations universally seen

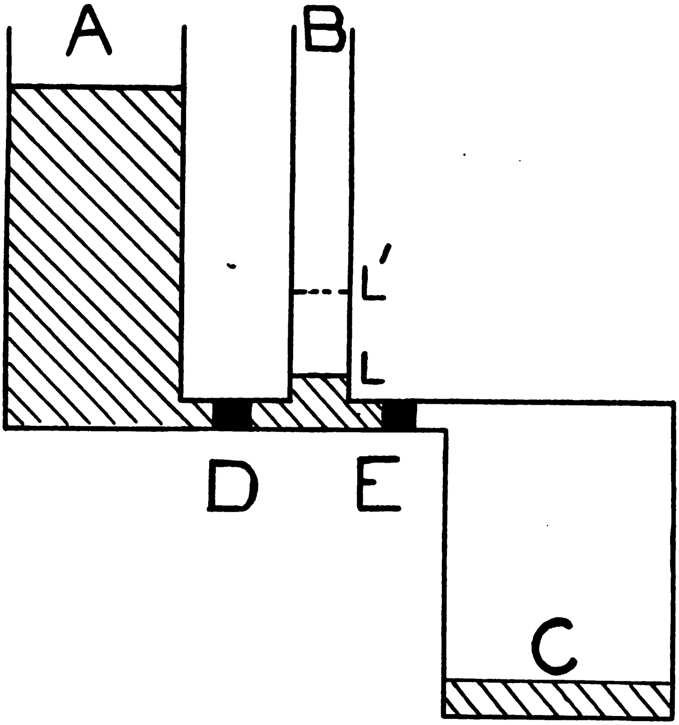

Fig. 1.

To be inserted between pages 278 and 279 of the October, 1913, number of the Journal.

among all living tissues. (5) Influences of variations in blood pressures, and of activities of internal organs, upon proportions of vascular constituents. (6) Inadequacy of experiments upon healthy animals and persons in showing effects produced in chronic diseases by circulating substances.

Conclusions will then be drawn regarding the nature of gout, intestinal toxemic, atrophic and hypertrophic arthritis; and the etiologies of the latter two will be discussed further independently.

Some of these ideas have been published already in slightly different form[1] but have been misunderstood and not as thoroughly explained as their importance warrants, and accordingly they will be amplified in new ways.

Influence upon the Composition of the Blood of Absorptions from the Digestive Canal combined with Excretions by the Excretory Organs.—Suppose three glass jars, *A*, *B* and *C* are connected with tubes, as shown in the diagram, and that there are adjustable valves at *D* and *E* which are exactly the same size and of the same capacity.

I. Let *A* be filled with water after *D* is closed entirely and *E* has been opened. When the valve *D* is fully opened the water rushes through *D* and *E* into the jar *C*. As it passes through *B* some water rises in this jar to a low level *L*, and then gradually subsides again as the entire amount empties itself into *C*. The temporary rise in *B* is due to the column of water in *A* transmitting a lateral pressure upon the stream as it flows through *B*.

II. Let the situation be the same as in *I*, with the exception that the valve *E* is partially closed. When *D* is widely opened now the water may rise in *B* temporarily to a higher level *L′*, owing to the partial obstruction at *E*. The obstruction causes the lateral pressure in *B* to be exerted for a longer time than in in the first instance, so that the level in *B* goes higher. Then it subsides again, and all finally collects in *C*. With *E* completely closed, and *D* open, the level in *B* rises and soon reaches the level in *A* as a limit.

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[1] A collection of Facts, Ideas, and Theories relating to the Diverse Elements that contribute to Success in Treatment of Joint Diseases. Relationships between Visceral Ptosis and Arthritis. Comparisons between Mild Intestinal Toxemias and Gout. *Boston Med. and Surg. Journal*, Mar. 6, 13 and 20, 1913.

III. Again suppose the situation to be as in I, with valve *E* wide open, and valve *D* only partially turned. The water then has no difficulty in passing through *E* and there may be no rise in *B* at all.

IV. Let the original situation in *I* exist again, then, as the water flows out, let more be added to keep the level high in *A*. As a result the level in *B* rises, remains constant, or fluctuates with changes in *A*.

From these simple experiments in hydraulics it can be seen that (a) the level of water in the cylinder *B* can be kept up indefinitely, by indefinitely adding water to *A* sufficiently to maintain its level high when water is flowing out simultaneously at *D* through *B* and E into *C*. (b) That when water is flowing through the system of jars and other conditions remain unchanged, the level of water in *B* can be raised simply by partially closing *E*. (c) That partial closure of *D* alone lowers the level in *B*, when it is standing at some level, *L* or *L'*, and water is running through *D* and *E*. (d) That it also falls in *B* when the rate of supply to *A* is made smaller, other conditions remaining unchanged. (e) Finally, although total amounts of water poured into *A* are equal in the three following instances, that the level in *B* is influenced nevertheless by the way the supply is delivered into *A*, and fluctuates differently according as small amounts are added at frequent intervals, larger quantities at less frequent periods, or as the supply is a continuous stream.

Let the three glass jars represent, the digestive canal, *A;* the blood stream, *B;* and the urinary bladder, *C*. And let *D* indicate the portal of entry of materials from the lumen of the alimentary tract at the gastrointestinal mucosa, while *E* is supposed to be a portal of exit at the renal epithelium.

In the apparatus the inflow of water into *B* in part is determined by the area of the valve *D* and part by the pressure of the column in *A*. These quantities decide the capacity of *D*.

The capacity of the human gastroenteric tract to absorb materials from its lumen depends upon its area, upon the amount of blood circulating through its walls, upon peristalsis and the vital activity of the living epithelium, upon presence of secretions in the intestine, etc.

However, it is to be remembered, that while the factors which determine the amounts of human absorptions and excretions are varied and complex, yet the ratio at any given time between rates of absorption and of elimination decide what concentrations and levels in the blood shall be, irrespective of conditions that determine absorptions or eliminations independently.

The ratio of rates of absorption to rates of elimination therefore are strictly comparable to the ratio between the rates of inflow and of outflow of water in the valves *D* and *E* of the system of jars. *And this simple apparatus indicates clearly a few of the actual fluctuating conditions existing from time to time in digestive canals, vascular systems, and urinary bladders of individuals.*

In passing, mention should be made of the fact that the height of the water in *A* alone, or the position of the valves *D* or *E* independently, or of the amount of water in *C* by itself, furnishes no positive information of the level in *B*. This agrees completely with observations of clinicians that analyses of urinary constituents, or analyses of intestinal contents, show nothing surely of quantitative blood conditions which exist at the time.

Factors that determine Beneficial and Deleterious Influences of Constituents in the Blood Stream.—Qualities of blood plasma depend upon the following factors: (1), Presence of harmful foreign constituents—toxins of pathogenic bacteria, metallic poisons, etc. (2) Variable complex proportions existing among all normal constituents of the plasma. (3) Variable individual concentrations of each substance from time to time as it is present in circulation. (4) Variable lengths of time that the influences act which have been mentioned under (1), (2) and (3).

Passing over (1) and (2) without discussion, emphasis is laid upon the fact that single normal constituents can produce harmful effects, without their essential properties changing, simply through abnormal increments and diminutions in their amounts in circulation; and also by unusually long retentions or absences from circulation. These two factors of time and degree of concentration should always be kept clearly in mind, that they can act separately or together, to produce harmful influences.

The harmful influence upon the tissues of abnormal degrees of concentrations of circulating substances is conveniently illustrated in gout. Persons may have very acute exacerbations of their chronic gouty symptoms after eating excessively, *e.g.*, amounts that produce temporary excessive concentrations of urates in the blood of non-gouty individuals.

Again, when the kidneys cease suddenly to excrete, as in uremia, very large amounts of many normal waste products presumably back up quickly in the blood; and these substances which are ordinarily harmless, under these very exceptional conditions are the only ones definitely known that will account for the violent delirium, convulsions, and comatose states that supervene.

Urates are waste products formed normally in tissue metabolism, and they pass through the blood stream to be promptly excreted. When they circulate for abnormally long times in gout before they are eliminated they produce injurious effects upon the tissues although the same degrees of concentration may occur in non-gouty persons for short times without harm, after the latter have eaten excessively of sweet-breads or have contracted diseases like pneumonia, leukemia, etc.

From these suggestive facts which are known, the question naturally arises—what happens when other individual constituents increase excessively in circulation, as for example, products of harmelss intestinal bacteria, etc.

To refresh readers' minds the composition of blood plasma is given, as stated in Howell's Text-book of Physiology.

Composition of the Blood-plasma.—Water, oxygen, carbon dioxide, nitrogen.

Proteins	Fibrinogen.	
	Paraglobulin	Euglobulin. Pseudoglobulin.
	Serum-albumin.	
	Nucleo-protein.	
Extractives, that is, substances other than proteins that may be extracted from the dried residue by water, alcohol, or ether.	Fats.	
	Sugar.	
	Urea.	
	Jecorin.	
	Glucuronic acid.	
	Lecithin.	
	Cholesterin.	
	Lactic acid.	
Salts	Chlorides of sodium.	
	Carbonate of potassium.	
	Sulphates of calcium.	
	Phosphates of magnesium.	
	Phosphates of iron.	
Enzymes and unknowns	Internal secretions.	
	Enzymes	Lipase. Glycolase, etc.
	Immune bodies (Amboceptors).	
	Complements.	
	Opsonins.	

Significance of Waste Products of Harmless Intestinal Bacteria.—Great numbers of harmless bacteria grow in the lumen of the digestive canal, and when a large quantity of unabsorbed food is present in it they multiply rapidly. The products of their growth enter the circulation, and are eliminated continually by the kidneys. When intestines are cleared out, or when little food is taken, naturally numbers of intestinal microorganisms diminish together with amounts of their products in circulation.

Are these substances of bacterial origin entirely harmless in all proportions when they circulate in the blood? And is it justifiable to say when an individual eats too heartily and has an acute digestive upset, with obviously increased intestinal putrefactions, with headache, nausea, vomiting, diarrhea and rheumatic pains developing and subsiding synchronously with intestinal bacterial activities, that these pathological symptoms are caused by harmless intestinal bacteria?

It is true that digestive functions may be normal in many such instances except that they are temporarily weakened by worry or fatigue. The digestive organs perform their ordinary functions, but are unable to convert and absorb the large quantity of food quickly. Their failure is only a quantitative one.

Ordinary intestinal microorganisms in consequence temporarily may thrive unusually well, and produce exceptionally large quantities of their normal waste products from the large food residue, and the latter in turn set up local irritations and systemic effects from their abnormal amounts. Examinations of the stools show no unusual species of bacteria.

Either the abnormal qualities in digestive processes, or abnormal qualities among bacterial activities are responsible for the symptoms; or else the latter are produced only by quantitative peculiarities, *e.g.*, by excessively large productions of ordinary bacterial waste products.

The first two assumptions are purely theoretical ones, while the third one is a fact. Consequently, from data at hand, the logical conclusion is that excessive amounts of these bacterial substances do get into circulation and cause pathological symptoms somehow until their quantities are diminished to normal degrees again.

These same products are the only causes known that can satisfactorily account for anemias, chronic joint diseases, etc., which accompany certain chronic digestive irregularities. Therefore waste products of harmless intestinal bacteria here are considered to assume pathological significance when they circulate in abnormal quantities.

Introduction into circulation of metabolic products of intestinal bacteria over unusually long periods of time in unusual amounts can be compared to retention in circulation in gout of metabolic products of tissue cells, urates, over unusually long periods of time in unusual amounts.

The error which is commonly made seems to be that exceptional *kinds of influences* almost always are sought when exceptional *quantitative degrees of activity of common influences* sometimes will account for pathological conditions and probably are the real causes. This is an important conception, and will explain many of the obscurities of autointoxications and intestinal toxemias.

Variations universally seen among all Living Tissues.—All will admit that different individuals vary greatly in appearance, weight, strength, endurance; and that organs also show many differences. One individual has strong muscles while another has a weak heart, a third a digestive apparatus of average development, and so on.

There are differences among different parts of the same kind. One muscle is stronger than the corresponding one on the opposite side, one lung may be stronger than the other, one kidney is bigger than the other, and some joints are more resistant than the rest of the articulations.

There are variable resistances among the different kinds of tissues to the same irritant; circulating substances may influence nervous structures first, kidneys next in order, articulations third, etc. Parts like the joints may be very resistant to one kind of influence, such as mechanical strains and pressures, yet be susceptible to other kinds, bacterial products, to greater degrees.

Organs vary in functional activity from time to time. Digestive functions that are weak may become strong and strong ones become weak. Muscular strength changes with exercise or lack of it.

Variable vital activities of individual tissue cells determine the variable anatomical appearances and degrees of activity of entire organs, and these vitalities of the smallest anatomic structures depend upon their congenital vitality and upon favorable or unfavorable chemical and physical influences throughout life.

Among all these variabilities it is exceedingly important to remember that large amounts of irritating substances in circulation alone do not always mean these latter will produce pathological symptoms in the tissues. For the tissues may happen to have very high powers of resistance, while at other times only slightly unfavorable proportions in the blood may lead directly to harmful changes when tissue resistances are weak. Some articular structures, for example, may happen to be congenitally weaker than others, or have been injured after birth, and these succumb when others maintain simultaneously their integrity during infectious fevers.

The same importance should be attached to the ratio between tissue vitalities and concentrations of vascular irritants, as holds for the ratio of the rates of absorptions to rates of eliminations from the blood stream.

The appearance of pathological symptoms and changes due to vascular causes, in joint tissues or any tissue, always is dependent upon three common variable elements at least; namely, (1) *vital resistances existing at the given time in the particular tissues*; (2) *concentrations of vascular irritants that are producing the symptoms and changes;* (3) *the lengths of time of action of such irritants.*

Influence of Variations in Blood Pressures, and of Activities of Internal Organs, upon Proportions of Vascular Constituents.— Excretions by kidneys are influenced by blood pressures. After severe hemorrhages when pressures are very low, kidneys temporarily cease to act; and in renal diseases impairment in kidney function is very commonly compensated for by high pressures and changes in the heart.

If kidney capacity is altered through changes of blood pressures this means that concentrations of vascular substances also may temporarily fluctuate, provided other conditions remain constant. For, by changing pressures and thus altering the outlet for substances in the blood, changes are made that are equivalent to turning the valve E in the simple series of jars used for illustration. The level of water in B, like concentrations of substances in the blood, fluctuates, rises or falls, according as the outlet is made smaller or larger when other conditions do not change.

Important internal organs like the liver, which help to change materials absorbed from the digestive canal, can be the source of unusual vascular conditions also, when tasks imposed upon them temporarily are too great.

Too many harmless bacterial waste products coming too quickly for the liver to handle properly may pass on into the general circulation without being as completely changed and combined as usual. These improperly prepared bodies following acute digestive upsets in some instances may then be the causes of symptoms.

There are two possibilities, namely, that the liver converts incoming products perfectly and completely, that pathological symptoms are the result alone of excessive quantities of substances normally in circulation. Or second that the liver acts normally, but does not have time to carry out its function of converting and combining materials brought to it, that some of them are swept through it and enter the circulation in slightly harmful, unusual form.

It is impossible from facts which are known to tell which of these two theoretical possibilities is the true explanation, or whether pathological effects observed depend upon both elements.

Whatever the explanation may be, it is unnecessary to assume new qualitative defects for hepatic activities, the failure being simply a quantitative one whereby some substance or substances enter the blood which ordinarily either are not present or not present in such great quantities.

It is certain that products of harmless intestinal bacteria pass through the liver and enter the circulation, and in chronic conditions that they must be present for comparatively long periods in variable, slightly harmful concentrations.

In chronic diseases there may be moderately long times when small quantities are present in the blood, these periods alternating with other times when they are entirely absent. There may be short intervals of circulation alternating with long intervals of absence, or *vice versa*. Finally, concentrations may vary irregularly between limits of complete absence and ones of high degree.

All these variations are simply quantitative ones among normal physiological processes, whereby some ordinarily harmless substance gets misplaced by combination of circumstances, and exerts its unusual influence because it should not be present where it is found, or because it is present in harmful amounts.

Inadequacy of Experiments upon Animals or Healthy Persons in showing Effects produced in Chronic Diseases by Circulating Substances.—Various experiments have been tried to prove or disprove the pathological influences of normal waste products.

Healthy persons have eaten sweetbreads in such large quantities that their blood has temporarily contained more circulating urates than gouty individuals but without development of gouty symptoms. Indol has been consumed by healthy men in very large amounts for short times without development of symptoms of toxemia. Ligatures have been tied around the blood-vessels of the kidneys in experimental animals so that there have been accumulations of waste products without typical uremic symptoms. Conclusions sometimes have been made from these facts that urates have nothing to do with gout, that intestinal indol does not produce any toxemia, and that normal waste products are not the causes of uremia.

These conclusions seem entirely erroneous to the writer for the following reasons: Three elements always enter into every vascular situation, namely, variable vital resistances in the tissues which show the pathological symptoms and changes; variable degrees of concentration of the circulating irritants; and variable lengths of time of action of the circulating irritants. These three factors will be discussed in turn.

Vital resistances are very different in diseased states from healthy ones. In chronic disease, when pathological changes are induced, the tissues have been subjected to fluctuating variable deleterious influences for considerable lengths of time before they succumb. They have slowly deteriorated until some unusual wave of concentration of the acting irritant, or an exceptionally long period of its action, or both, finally upsets the delicate slowly declining healthy tissue balance.

Furthermore, degrees of concentration of vascular irritants do not depend solely upon quantities of them absorbed from the intestines. Large amounts may enter the circulation and be quickly eliminated by kidneys of large capacity without abnormal quantities backing up in the blood. Therefore ingestion of large amounts do not necessarily result in vascular abnormalities as some experiments assume. Even when undue accumulations in circulation are effected by experimental means these do not duplicate the conditions which exist in chronic diseases, *e.g.*, the fluctuations great and small, from time to time, within wide limits, in many possible variable alterations and combinations.

Finally the length of time of action of substances in most experiments is entirely different from the lengths of time the same substances exert their influences in chronic pathological conditions.

Therefore it will be seen upon close inspection that attempts by experiments at proving or disproving harmful influences of common circulating sustances are wholly inconclusive. Healthy tissue resistances in normal individuals are high, and there are reserve vitalities which require weeks of action by mild circulating irritants before they are overcome. Furthermore concentrations of vascular irritants cannot be regulated experimentally to agree at all closely with those of chronic pathological ones.

It is the writer's opinion that negative experimental results should be disregarded entirely in such complicated situations, because experimental conditions are so different from actual ones existing in patients. Admission should be made also that common waste products still are the only substances which will satisfactorily account for pathological changes which undoubtedly are induced.

Conclusions from Consideration of the Six Foregoing Topics.—Gout would be defined by the writer as the group of pathological symptoms and changes which are induced in susceptible persons by abnormally large proportions of urates in circulation. It is considered to represent the direct effects exerted upon body tissues by a normal waste product of tissue metabolism as it circulates in an unusual way.

Intestinal toxemic arthritis would be described as the results of a harmful influence exerted directly upon the articulations by abnormal quantities of circulating waste products from ordinarily harmless intestinal bacteria.

However, if capacities of kidneys for excreting urates or intestinal bacterial products are influenced by nervous causes, previous infections, lead, alcohol, exposure to cold and dampness, heart diseases, repeated pregnancies, unknown internal secretions, etc., then these circumstances have to be recognized as factors, more or less remote, that contribute to the physiological balance between inflow and outflow of urates and intestinal bacterial products from the blood stream.

If excessive amounts of urates or bacterial substances enter the circulation it must be admitted they may at times contribute to unusual concentrations: and that therefore conditions in the alimentary tract and body tissues ought to be considered contributing causes of arthritic manifestations.

Lastly if any infections, exposures, traumata, arteriosclerotic changes, etc., lower local resistances in *articular tissues* which subsequently develop pathological changes, then these influences, too, must be thought of as contributing elements in development of the two mentioned specific diseases, gout and intestinal toxemic arthritis.

The causes of gout and of intestinal toxemic arthritis may be described as being concerned with defects in the healthy balances maintained by the articular tissues toward specific vascular constituents.

Atrophic arthritis and hypertrophic arthritis, it seems, should be placed in the same group with gout and intestinal toxemic arthritis, as will be indicated under discussions of the etiologies of these two deforming types of joint troubles.

The writer would define atrophic arthritis as the group of pathological changes produced in the tissues by the direct action upon them of abnormal quantities of circulating creatinin or an allied nitrogenous substance; and hypertrophic arthritis seems to be due to the direct effects of circulating calcium salts upon the articulations.

With both of these diseases, as with gout and intestinal toxemias, very many contributing causes are recognized to exist which may influence variable tissue resistances in various organs including the joints, also variable concentrations of the circulating specific irritants, and variable lengths of time of action of these substances.

Etiology of Atrophic Arthritis.—Creatin is a normal constituent of skeletal muscles, and it is readily changed into its anhydride, creatinin. The latter is excreted in the urine in small amounts like urates; and Folin has found that creatinin excretion upon a meat-free diet is constant in normal individuals although there are slight variations among different persons. The daily excretion of creatinin amounts to 1.0–1.7 grams as compared with approximately one gram of uric acid in an average normal person.

Folin found further that about 80 per cent. of creatinin given with food was again eliminated, while creatin taken did not appear in the urine as creatinin, but was partly retained by the body and partly eliminated as creatin.

Hammarsten* says "creatinin elimination does not run parallel with the urea and the total nitrogen, and consequently is not in general greater with food rich in protein than with food poor therein. On the contrary its extent, as shown by other conditions, is dependent upon the intensity of the metabolism in the cells, and the creatinin, according to Folin, is a product of the endogenous protein metabolism."

There are still very many obscurities about the intermediate processes taking place in glands and body tissues connected with transformations of creatinin and creatin, but all these various complexities can be passed over to insist upon the simple idea that creatinin or creatin possibly circulates in the blood of atrophic arthritic patients in some unusual way.

Clinical Observations upon Atrophic Arthritis.—I. There are exceedingly rapid diminutions in size and strength of *skeletal muscles* occasionally in atrophic arthritic patients. These cannot be accounted for by disuse because return of strength and increased volumes are observed when disuse continues. Acute pathological symptoms, pain, fever, trophic skin changes, etc., reach their highest degrees when muscle wasting is most rapid; and both tend to return again simultaneously to normal levels. Perhaps the acute symptoms are caused by unusually rapid liberations into the blood of creatinin, a product of endogenous protein metabolism from the rapidly wasting muscles.

II. Some patients have the onset of progressive atrophic arthritis definitely associated with childbirth. Two or three weeks after termination of pregnancy, when physiological functions are returning to normal again, the period when the uterus is shrinking in size and kidneys are readjusting themselves after unusual tasks imposed upon them during pregnancy, severe joint symptoms begin to appear frequently for the first time.

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* Text-book of Physiological Chemistry.

Perhaps these are due to renal readjustments striking a slightly different level after childbirth from the one the kidneys previously maintained, and that they are analogous to subinvolutions of the uterus. Among such changes occasionally there may happen to be ones altering levels of creatin and creatinin excretion.

There must be some cause for obstinately progressive arthritis and eclampsias developing at such times; and altered metabolic functions undoubtedly do occur then.

The only theoretical idea needed is one of occasional decided change in kidney function at such periods. That, after the unusual activities of the renal epithelium during pregnancy stronger stimulations are required subsequently to excite the kidneys to normal waste products. It is assumed by the writer that the "threshold stimulus" which creatinin gives to the kidney has been raised, and that creatinin in consequence is excreted with greater difficulty by the kidney at ordinary grades of vascular concentration.

It seems more plausible to assume that some new quantitative changes in renal functions do account fcr the obvious fact, the occasional development of postpartum atrophic arthritis, than to believe a more unjustifiable theory that kidneys cannot occasionally change rapidly in unfavorable as well as favorable directions.

The work of Folin and Denis* shows "there is apparently no relationship between the amount of uric acid and the amount of urea or total nonproteid nitrogen in human blood," and these findings help to strengthen the belief of Magnus-Levy and others that the kidneys exert individual selective actions upon vascular constituents like all other secreting glands. That, for example, there may be abnormal retentions of urates in gout while urea is excreted normally at the same time.

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* *Journal of Biological Chemistry*, Feb., 1913. Protein Metabolism from the Standpoint of Blood and Tissue Analysis, VI. On Uric Acid, Urea, and Total Nonprotein Nitrogen in Human Blood. Otto Folin and W. Denis.

Some kidneys probably are able to excrete uric acid and urea and yet fail quantitatively with some other waste product, like creatinin or intestinal bacterial substances.

Theoretical assumption of absolute invariability of kidney function is unwarranted by the data at hand, and is entirely antagonistic to the fact that all living tissues occasionally show many anatomical and functional peculiarities.

III. Some patients with well-developed progressive atrophic arthritis after severe pneumonia have pronounced ameliorations of joint symptoms temporarily during the convalescent period. During the fever period of pneumonia, when patients are prostrated and very ill, there are increased eliminations of creatinin, while during convalescent stages there are subnormal eliminations by the kidneys.

This may mean that such patients for the time have their joint conditions improved because concentrations of creatin or creatinin in the blood then are temporarily lowered. The period of increased joint symptoms during the fever corresponding to the period of increased vascular concentration of creatinin would be overlooked owing to the prostration and illness produced by the pneumonia.

IV. Ether administered to atrophic arthritic patients sometimes is followed by very well-marked ameliorations of symptoms for a short time when pathologic articular processes are exhibiting their greatest intensities. Ether anesthesia temporarily disturbs renal functions, and temporary relief from joint symptoms, lasting the same length of time as the kidney disturbances, in this instance, may be due to increased eliminations with temporary lowering of vascular concentrations of creatin or creatinin.

One typical atrophic arthritic patient, who was temporarily relieved by etherization, showed a distinct temporary increase in creatinin elimination immediately after this anesthesia, but at the time no significance was attached to the fact and unfortunately the precise data were lost.

V. A few severe cases of chronic atrophic arthritis, which have subsided, have been benefited according to the firm belief of such patients, by a vegetarian diet. Although little dependence can be placed in such beliefs generally, there is the plausible feature to this one that there may have been actual relief from the creatinin-free diet which it represents.

Effects of Creatin or Creatinin.—Supposing that abnormal amounts of circulating creatinin do account for symptoms, it will be seen that they could explain vasomotor changes in the skin, uniform thinning of the bony trabeculæ in the marrow of many bones, trophic skin changes, sweatings and pronounced painful symptoms, by assuming a direct action of the circulating irritant upon *living tissue cells* in skin, capillaries, sweat glands, bone marrow and nervous structures as well as upon the kidneys.

As compared with urates, which deposit in bones, skin, glands, cartilages and other tissues thus unmistakably identifying themselves with the pathological process, there may be analogous actions with creatinin which are less appreciable on account of the solubility of creatinin.

It is unlikely that gout would be as well understood if urates did not happen to crystallize out in easily identified forms; because even as the matter now stands, it is difficult for many persons to appreciate that harmful properties can depend wholly upon unusual concentrations and long-continued influence of ordinarily harmless metabolic substances.

Attention must be called to the fact that this theory of atrophic arthritis is not disproved if reliable blood tests show at times no increase in proportions of creatin or creatinin, for there may be long periods of excessive concentrations alternating with long periods of normal proportions, as clinical symptoms indicate; nor is it disproved by high concentrations existing without symptoms for short times, as has been proven by finding excessive quantities of water circulating in the non-gouty for short periods.

If readers will recollect that a sound theory may rest upon very flimsy evidence when obscurities and complexities are great, there may be less condemnations of this paper.

There cannot be very striking proofs for causes which are acting in such ways, but with persistence it is possible to detect slight clues which lead to final disclosures of real causes among common substances, the latter simply acting in slightly unusual, unsuspected ways.

Lurking behind variations and interactions that normally occur without harm in many persons, and under right combinations of circumstances which are almost impossible to detect among the many similar ones seen in health, common well-known substances. probably act in perfectly understandable manner, when once recognized, to produce at times characteristic pathrological changes.

Regarding the many objections and alternate possibilities which must arise in the minds of careful readers, the writer wishes to say that he has considered many of them, and this theory seems to fit all known facts better than any other one. Confusion will be avoided therefore in this outline by omitting complete discussions of all possibilities.

There are many other theories, and the process of eliminating false ones can be started by the final test for this one, search for quantitative abnormalities from time to time in the creatinin content of the blood. Fortunately this now seems possible with Folin's colorimetric methods for the quantitative estimation of non-proteid nitrogen of the blood; but the writer believes these proofs should be attempted by laboratory chemists and not by clinicians.

Etiology of Hypertrophic Arthritis.—Review of some of the well-known clinical features of hypertrophic arthritis shows it to be a disease of middle and old age, which in its extreme forms involves ligaments around the joints as well as osseous structures. Spinal involvements of osteoarthritis convert the spinal column at times into a rigid support from calcifications of the vertebral ligaments; and this fact indicates that pathological changes are not due to a peculiarity alone of periosteal tissue cells, but that the changes are produced by the influence of circulating calcium in its effect upon various tissues.

That calcium is not an inert substance in the blood is very well shown by physiological experiments upon extirpated hearts of frogs. Ringer proved that a frog's or terrapin's heart can be kept beating for long periods upon a mixture of sodium chloride, potassium chloride and calcium phosphate or chloride. The proportions in his solution are respectively 0.7 per cent. NaCl, 0.03 per cent. KCl and 0.025 per cent. of $CaCl_2$.

Furthermore, it is known if an extirpated terrapin heat is irrigated with blood from which the calcium has been precipitated the heart ceases to beat, although all other constituents of the blood are present. Normal contractions can be started again by adding calcium chloride in right amounts to the oxalated blood.

When calcium ions are present in quantities above normal, or when in a proportional excess over the sodium or potassium ions, they cause a condition of tonic contraction designated as calcium rigor. It is to be noted that calcium in circulation is present only in very minute quantities, and that very small amounts cause important changes at least in the normal activity of muscle tissue. Presumably with other types of cells also, there are characteristic influences exerted by calcium salts before deposition of calcium actually occurs in them.

In the urine calcium occurs chiefly as phosphates, and together with magnesium is eliminated in quantities of 1 to 2 grams daily. Lime salts which are absorbed are in great part excreted again into the large intestine, and the quantity of lime salts in the urine therefore is no measure of this absorption.

Quantitative determinations of calcium salts in the human circulation from time to time have not been made that the writer is aware of, but metabolism experiments upon animals have been tried.

During starvation bones are known to lose some of their calcium, and upon the other hand Magnus-Levy* mentions an experiment by Herxheimer who consumed large quantities of calcium carbonate and stored up 16 grams of lime in his bones in eight days.

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* Von Noorden: Metabolism and Practical Medicine.

Another experiment of Rey quoted by Magnus-Levy shows that 50 per cent. of lime introduced subcutaneously into dogs still lingers in the body after an interval of three or five days, and the amount in the blood during this time was twice as great as normal.

None of these observations have any important bearing, however, upon osteoarthritic patients who are struggling to maintain the calcium balance for their slowly deteriorating tissues, as the latter react possibly to fluctuating harmful vascular concentrations of lime salts.

The experiment of Herxheimer, who consumed calcium carbonate and stored it up rapidly, demonstrates nothing regarding vascular concentrations of circulating calcium. It shows only that the bones have the power in health of rapidly removing from circulation and storing large quantities of calcium as they would need to do if calcium is likely to cause harm in increased proportions.

And it is quite conceivable that such amounts given to persons with beginning hypertrophic arthritis might precipitate a serious arthritic attack in deteriorated joint tissues which are just on the verge of succumbing.

In favor of the idea that there may be increased concentrations of calcium in circulation, which account for hypertrophic bone changes, should be mentioned the fact that bones undergo atrophies like all tissues, in old age. Presumably they lose some of their reserve power for taking care of excessive quantities of lime salts in the food quickly, so that proportions in circulation perhaps rise more readily in old age. Bone atrophy in old persons, according to Magnus-Levy, shows itself as an increased porosity, and very gradual diminution in the contained lime and phosphates.

There should be some hesitancy, however, about assuming abnormal retentions of calcium in circulation as the sole cause of all hypertrophic joint changes when the well-known tendencies of tissues toward calcification are thought of. Calcification usually occurs in parts of tissues that are dead, or are in a condition of reduced vitality as a result of some antecedent abnormal process, as a rule of inflammatory nature.

It may be that articular tissue deterioration is more important than abnormalities in vascular concentrations of calcium in the majority of cases of osteoarthritis. Concentrations may remain at their normal level and the tissues may slowly sink in their vitality to a degree that permits calcium in its ordinary proportions to form loose combinations with the dying cells and connective-tissue fibers.

Whatever the correct explanation is, there is an overcoming of the healthy balance between joint tissues and blood with the obvious deposition of calcium.

Presumably there are internal molecular groupings within tissues that decide whether deposits shall be lime salts or urates, and in this connection it is interesting to observe that gouty and hypertrophic processes occur separately but also are frequently found together in the same individual.

This naturally would be expected when it is considered that the blood usually contains several substances which are capable of producing characteristic changes in the articulations.

In harmony with this idea are the findings clinically of hypertrophic and atrophic changes in the same joints, and presumably also intestinal toxemic effects are produced, along with the others in some instances, but are entirely overlooked because of the prominence of visible hypertrophic, atrophic, or gouty changes.

When one stops to consider how ligaments, periosteum, cartilages, etc., have some congenital peculiarities and variable initial resistances to begin with, it does not seem strange that so many different effects, locally in the joints, are produced eventually by various continued mechanical strains of body weight, occasional local traumata, exposures of the smaller joints to extremes of temperature, long-wasting fevers, chronic infectious processes, overfeeding, prolonged intestinal putrefactions, arteriosclerosis, metabolic changes at the menopause, variable blood pressures, etc.

It is not unlikely the causes of arteriosclerosis and osteoarthritis are identical in that they exhibit simply the direct action of calcium in the blood upon the tissues, as reactions between the two are decided by vital resistances of the particular living tissues, variable concentrations, and variable times of action of the specific circulating substance. No other new specific cause for pathological conditions is needed.

Practical Uses of these Results of Exhaustive Critical Studies.—These ideas, which have been reasoned out directly from established clinical and scientific data, presumably could not have been arrived at from experiments alone, owing to the many variable factors always concerned which cannot be controlled and accounted for in direct experiments.

Like many complicated truths encountered in clinical practices which cannot be proved, these ideas furnish a point of view also that modifies actual treatments of patients very greatly if they are understood, therefore they become of exceedingly great practical importance.

With chronic joint diseases, instead of adhering to any one of the many theories of nervous, infectious, metabolic, renal, internal secretory, intestinal origins, etc., which now prevail, many physiological defects should be recognized at times to be contributory to the development of these pathologic states. Probably all such theories are partially correct in selected instances, and treatments in consequence always should be carried out in a comprehensive physiological manner.

Digestive irregularities are corrected as far as possible; normal excretory functions are mildly stimulated; orthopedic appliances are used to protect weakened articulations, general tonic measures, hydrotherapy and drugs are prescribed, rest for the nervous system is attempted, and personal hygiene is attended to in a thorough, careful manner.

Special measures also are directed toward minimizing intestinal bacterial putrefactions in intestinal toxemic types. Meats, fish and creatinin containing meat extracts can be reduced in atrophic arthritis. Calcium containing drinking waters, excessive quantities of vegetables which generally contain more calcium than flesh foods are minimized in hypertrophic types in order that waning tissue vitalities shall not be subjected to excessively large quantities of circulating calcium salts.

Joint tissues locally are given supportive treatments or stimulative ones by various physical means according to their physiological needs. Blood and lymph conditions in the joints are dealt with by thermal measures, electricity and massage.

The value of complement fixation tests and vaccines in diagnosis and treatment of obscure infective foci is recognized, as also is the important rôle played by chronic infectious processes in lowering articular resistances, thus contributing later in many instances to development of noninfectious types of joint disease.

In brief, critical studies and generalizations give well-balanced, well-defined, practical plans for treatment that yield successful results in many cases where special methods fail without this general understanding.

They permit more accurate prognoses, and explain why so many different remedies, which deal with only one of the many involved physiological functions, are all partially successful at times. They show why all treatments are unsuccessful in certain advanced cases; and they help to indicate the practical differences between combinations of several independent special treatments which are taken as though individuals are groups of unrelated organs, from combinations of several special treatments taken with careful general supervision of the general condition, and with thought of the probably relative importance of various measures which are tried.

With adequate general understandings of chronic arthritis, practising orthopedic physicians have the best opportunities for relieving their patients through skillful applications of reliable well-known remedies, and for this reason they should be interested in perusing the somewhat complicated, difficullty presented ideas of this paper, because in no other way can this practical point of view be gained.

XXIII.

THE DEVELOPMENT OF ORTHOPEDIC TEACHING IN AMERICA.

BY CHARLES F. PAINTER, M. D.

A number of factors have contributed to put the specialty of orthopedic surgery on its present foundation. A desire to solve some of the problems presented by chronic disease has been the fundamental incentive. The efforts of a few pioneer minds who outlined the work to be done and made a start on its accomplishment and the gradual dissemination of knowledge concerning the specialty through the establishment of courses of instruction in a few of our medical schools have been instrumental in bringing about the present results.

It has fallen to the lot of those who have been engaged at the outset of this last-named propaganda to further the cause the most, particularly those who were instrumental in gaining for the specialty recognition on the medical faculties. The best evidence of the appreciation on the part of the student body of the value of courses of instruction offered in this subject is the fact that only one or two subjects in which electives are offered in the Harvard Medical School are more popular than the elective in orthopedics. This means more in a professional school than it would in college where elective courses are often popular because they are "snaps." When a man is electing in a professional school his attention is fixed on the selection of the courses that give him the best preparation for his life-work. Therefore when a man elects a course in orthopedics he pays a compliment to the character of the course.

The demand which brought specialization into existence was the appreciation of the fact that progress along certain lines could not be accomplished without the devotion on the part of some, of their time and their ability, to special study and investigation. Opportunity for such study could only come through the advantages of special clinical facilities and the employment of the time of one man or a group of men for long periods upon a single subject. The prime reason for the advance of specialization, among its originators at least, was not the desire to shirk the responsibilities of general practice or to amass a fortune speedily through the charging of the larger fees that special preparation and equipment justified but the earnest hope that something might be added to the sum of knowledge in a particular subject. It was but natural therefore that when that increment of special knowledge had been acquired it should become matter suitable to be imparted to students and those graduates who desired to serve their constituency to the best of their ability. For this reason our medical schools have one after another recognized the necessity of sending out their graduates equipped with some knowledge of orthopedic surgery. A brief review of the history of the establishment of courses of instruction in various large centers may not be amiss in this connection.

Philadelphia, New York and Boston seem to have been the pioneer cities in which orthopedic surgery became established. At the University of Pennsylvania Dr. DeForrest Willard was nominated as lecturer in orthopedic surgery in 1883. From that time on lectures were given to third and fourth year students but the Chair of Orthopedic Surgery was not established until 1889. In 1883 at the Jefferson Medical School Dr. Oscar H. Allis gave the instruction in orthopedic surgery in a postgraduate course. In 1886 he was elected Clinical Lecturer on Orthopedic Surgery and gave a course to undergraduates which was elective or optional. In 1891 Dr. Allis resigned. Dr. H. Augustus Wilson was elected Clinical Lecturer, the course becoming for the first time a compulsory part of the curriculum. In 1892 the title was changed to Clinical Professor. In 1894 the title became Professor, without a seat in the faculty. In 1903 a seat in the faculty was given the Professor of Orthopedic Surgery. At the Medico-Chirurgical College a Clinical Chair in Orthopedics was created in 1896. Before that time the subject had not been taught. In 1910 Dr. J. P. Mann was elected to the chair. At Temple University Orthopedics was taught as a part of general surgery until 1908. From 1908 to 1910 there was a lecturer on orthopedic surgery. In 1910 a clinical professorship was established and has been filled since that time by Dr. H. Hudson.*

In 1841 the first private clinics in orthopedic surgery in this country were held by Dr. Detmold in New York and in the *New York Gazette* for 1851 it was announced that Dr. Detmold "has consented to give a course of lectures on orthopedic surgery." Where these were given is not stated; probably not in connection with any medical school.

In 1853 Dr. Lewis H. Sayre was appointed to the staff of the Bellevue Hospital. This marked the beginning of orthopedic work in that hospital.

In 1861 Bellevue Hospital Medical College was organized and the first Chair of Orthopedic Surgery was established. Systematic instruction was commenced here at this time by Dr. Sayre with two clinics per week.

In 1863 the Society for the Relief of the Ruptured and Crippled was incorporated through the efforts of Dr. James Knight who for twenty years had been treating orthopedic patients and those the subject of hernia.

In 1866 the New York Orthopedic Hospital and Dispensary was started by Dr. C. F. Taylor. There was provision made for instruction in orthopedic subjects by the trustees and courses of lectures were offered during the winter months.

In 1873 St. Lukes appointed a visiting orthopedic surgeon.

In 1874 the University of the City of New York appointed a professor of orthopedic surgery in its post-graduate course.

In 1875 the Women's Medical College appointed a lecturer in orthopedic surgery.

In 1878 the New York Hospital followed suite.

In 1882 the New York Polyclinic and the Post-Graduate

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* Quoted from W. R. Townsend's Presidential Address before the American Orthopedic Association in 1889.

Medical Schools both established teaching chairs for the specialty.

In 1892 the Presbyterian Hospital opened an orthopedic clinic.

In 1894 the College of Physicians and Surgeons commenced the teaching of orthopedic surgery.

In 1898 the Long Island College Hospital established an orthopedic clinic.

It will thus be seen that though there was some attempt made in those earlier years to teach those who desired to learn it was chiefly from a philanthropic standpoint that orthopedic cases were considered in New York City.

At the Harvard Medical School in Boston the first instruction was given in 1887 and 1888. This was an optional course. The name of Dr. Buckminster Brown is associated with the early instruction in orthopedic surgery in Boston.

In 1893 Dr. E. A. Bradford was elected as assistant professor and was made full professor in 1903. The first clinical advantages for the study of orthopedics antedated the establishment of clinical instruction in the Boston schools by a good many years. The first of these opportunities was opened up with the foundation of the Children's Hospital which was in 1869. The Boston Dispensary has an orthopedic clinic quite early in its history and except for these there were no others until in 1895 at the Carney Hospital the first orthopedic clinic for adults was established by Dr. Joel E. Goldthwait. In 1900 the Massachusetts General Hospital followed with the establishment of a consulting service for orthopedic cases and on the completion of the new Out-patient Department building in 1904 a regular out-patient service was inaugurated and a little later a special ward was built for house cases of this sort. Instruction in orthopedic surgery has been given at Tufts Medical School since 1899.

In 1887 there were five medical schools in the country providing instruction in orthopedic surgery; in 1902 Dr. H. Augustus Wilson pointed out the fact that nearly every school in the country was giving such instruction, chiefly through clinical lectureships but in a few cases through the medium of a full professorship.

Along with this development in the medical schools the state boards of registration in medicine commenced to put questions on orthopedic surgery into the state board examinations showing that it was coming to be recognized that some knowledge of this subject was regarded as essential to a well-rounded medical equipment. Another fact significant of the growth of interest in the work of the specialty is that between the years 1825 and 1860 there were only 172 titles in medical literature on orthopedic subjects. In the years 1889–1890 there was compiled a list of 583 titles on orthopedic subjects and this was without doubt incomplete.

At the present time it is greatly in excess of that number for any single year. Text-books and journals devoted to the specialty and other methods of disseminating orthopedic knowledge help men to keep the subject before the public and the general profession.

Though the teaching of orthopedic surgery was carried on in this country as early as 1841, and under that name, the subject did not command recognition by the medical schools until 1861 and it was not until about the time that the International Congress of Physicians and Surgeons in 1900 formally acknowledged the exsistence of such a specialty that the schools generally offered systematic courses. From that time on we have noted the schools of this country, one after another, created positions on their teaching forces for the instruction of students. An influence which doubtless contributed a good deal to the establishment of orthopedic teaching upon a university basis was the fact that several institutions had been founded for the treatment of cripples and the success of these from a philanthropic point of view had enforced upon the public and the profession the need for the care of this class of patients in metropolitan communities. The Society for the Care of the Ruptured and Crippled in New York was one of the earliest of these and was followed in a short time by others of a similar character both in New York and elsewhere. As these grew the need for men who were competent to care for the work and to enlarge it became evident as well as the opportunity for engaging in that sort of practice on other than philanthropic lines. It was to meet such demands as these that the medical schools put this subject into their curricula. At first the scope of the specialty was much narrower than at the present time. Tuberculous diseases of bones and joints, rhachitis, congenital deformities and a few other minor subjects not now considered a part of the specialty, were handled at that time by orthopedists. The stigmen of "harness makers" and other similar terms indicated that at first the surgical management of the diseases which were being treated was not to be undertaken by those practising orthopedic surgery and even by those practising the specialty there have been differences of opinion on this score and at times the practice has been predominantly mechanical and at other times predominantly operative. At present the one who espouses this special line of practice must be competent technically as a surgeon and also must possess, for the greatest success, the temperament for handling chronic diseases and considerable appreciation of mechanical problems.

The teaching of orthopedic surgery consists in the inculcation of so much of the above as is capable of being imparted through instruction; in arousing the interest of students in the problems of chronic medicine and surgery and in demonstrating the application of the mechanical principles which lie at the bottom of a good deal of the treatment of orthopedic conditions.

I think it is distinctly a fourth year subject and believe it should be closely affiliated in its academic relations with the department of surgery.

In the category of conditions which are now treated by the orthopedic surgeon are many that touch general medicine at many points and therefore more than perhaps any other specialty orthopedic surgery calls for cooperation between the internist and the specialist. And so it is in connection with that branch of internal medicine which deals with nervous diseases.

One who practises orthopedic surgery must have at his fingers' ends a few of the fundamentals of neurology for diagnostic purposes.

So it is with the contact with any of the other specialities as for example pediatrics, gyneology, obstetrics, genito-urinary diseases, etc.

It appears therefore that one who undertakes to teach this subject in its present-day acceptation—and this might properly be said of any other specialty—must have a fairly broad general knowledge and experience and should be in a position where he can study his cases with the aid of those whose knowledge of special lines of work is such that this aid may be profitably invoked in diagnosis. This is especially true of the large group of cases that are now falling into the hands of the orthopedic surgeon for treatment, viz., the chronic arthritides. The very nature of the subject furnishes more completely than in the case of any other disease a field for the activity of the orthopedic surgeon. The investigation of the causes is certain to be as chronic a process as the management of the treatment and hence the need that the subject be taken up for investigation as well as for treatment by those who are accustomed to the handling of chronic problems.

In the teaching of this subject to students I believe that our function is more than to discriminate for example between cerebral and infantile paralysis or between tuberculous and nontuberculous arthritis; it is, or should be, to impress upon them the need for viewing diseased conditions, as, in very many instances, not diseased conditions at all but primarily as sequences of disturbances not in any way related to morbid processes. That the intricacy of the human mechanism and the vagaries of the developmental progress of the race have created numerous points of least resistance and the part played by these factors in the production of conditions which incapacitate the individual must be reckoned with in our study of arthritis, deformity, etc. It is our duty to inculcate in our students the necessity of never abandoning a fight against chronic difficulties until the last gun has been fired. The details of treatment and the reasons for arriving at diagnostic conclusions are, of course, important, but thorough grounding in these without the acquirement of the other points of view will never make an orthopedic surgeon and will come far short of giving to a man who desires to take care of the kind of patients that an orthopedist has to care for, the equipment which he should have. For the accomplishment of these purposes I believe that the didactic lecture is an essential part of the system of instruction. This provides the instructor with the opportunity to give expression to broader views on the philosophy of treatment than can be obtained from a clinical talk at the bedside. It should not be a mere enumeration of the symptoms, arranged in an orderly text-book fashion, and only such illustrations should be used as tend to make clear a point difficult to enunciate by the spoken word alone. It is impossible to cover satisfactorily solely by illustrations in one lecture per week through the school year, even the small number of topics that belong to the subject of orthopedic surgery. It therefore seems best in didactic lecturing for the lecturer to lay most of his emphasis upon etiology, treatment and prognosis, which does not make it needful that the lecture read like Homer's Catalogue of the Ships but gives him time to make it a real exposition of the lecturer's views of the disease in question and of his personal experience in its treatment. This leaves the other subjects, such as the symptomatology, diagnosis, differential diagnosis, etc., to be taken up in the "quizz." This should succeed the lecture and preparation should be required for it, the pages in the text-book to be read by the student being announced in advance. The purpose of the quizz should be to ascertain the students, difficulties in grasping the subject and so will often resolve itself into a half lecture, half quizz. The quizz should as a rule be given by the chief of the department. To supplement the lecture course, it is very helpful to have a series of demonstrations occurring once in two or three weeks, taking the place of the quizz on the quizz days. At these demonstrations one of the assistants in the department should collect photographs, specimens, models, diagrams, X-ray plates, appartus, anything that serves to make clear the subject already gone over in the lecture and demonstrates them before the class. Such demonstrations are more or less informal; the exhibits are described and their bearing on the subjects they are designed to illustrate suggested, frequently in answer to questions propounded by the students. This furnishes the student with his illustrations, a little remote from his lectures to be sure, but the method has the advantage of leaving the lecturer untrammeled by the necessity of being the demonstrator of his lecture illustrations. Such parts of these demonstrations as seem worth while keeping on exhibition for a week or a fortnight may be arranged in some small room, off a labora ory for example, and left for those who are particularly interested to study at their leisure without the assistance of any instructor. Full notes should be appended in typewritten form and references to the case histories where patients are concerned or specimens exhibited should be provided. No one will use this exhibit except the few in the class, perhaps a half dozen, who are especially interested but it is the function of the instructor to provide for this small group just as much as for the class as a whole. The clinics provided should be arranged so that only a small number of men can be assigned to one instructor. Where possible the concentration plan may be followed, *i.e.*, for a period of six weeks or two months a section of not over ten should receive all their clinical instruction in the specialty. If the students have four clinics per week given for two consecutive hours there is opportunity to show a good deal of material in a satisfactory manner. One of these exercises each week should be a clinical lecture, more formal than the out-patient clinic. This should be given in the hospital amphitheater and following it there should be a ward visit at which the methods of bed treatment of the house cases may be discussed. Very little operating need be done before the students in the required course. They learn little from it and the time may be more profitably spent. On the other hand, plenty of opportunity should be accorded for observing the technic of the use of plaster of Paris. It is a great advantage where possible to have the orthopedic diseases of adults and children taught in separate clinics and division of clinics in this way is an advantage in itself because it does not so continuously interfere with the conduct of any one clinic and leaves those who are in care of the patients free to prosecute their own researches uninterrupted by undergraduate teaching. These courses given in the clinics to each succeeding section should be as nearly uniform as possible and should be systematically presented. It has always been my custom to give to each section as a part of the first of their clinics a talk on the methods of physical examination in orthopedic conditions, taking up the matter regionally. One of the clinics is often given by the students with the instructor as the quizz master while the others are demonstrations by the instructor. At the one conducted by the students the patient is turned over to them for history taking, physical examination and the prescribing of treatment. After they have had sufficient time in which to study the case it is reviewed by the instructor and the students quizzed as to the reasons for their diagnosis and treatment. The material from whatever operations have been performed during the year should be worked up by an assistant and at the end of the year two or three pathological demonstrations may be given at which the gross and miscroscopic appearances can be shown. So it will usually be possible to illustrate in this way nearly all the pathological changes common to orthopedic surgery.

If an elective course is offered it should come in the second half year and should take up other topics than those treated in the required course. Arrangements should be made to have those who elect it serve as clinical clerks on an orthopedic hospital service. Monthly conferences at which cases carefully worked up by the student are presented and discussed is a valuable exercise. Careful clinical study of hospital cases should be encouraged and an important part of the course should be in the pathological laboratory.

From desultory clinical instruction confined largely to such cases as required some form of apparatus treatment to the expenditure of an amount of time approximating that just now outlined and including a much wider group of subjects, orthopedic teaching has advanced.

To the teacher and investigator there is no more fruitful field than is offered by this subject. There are abundant problems to be solved the bearings of which upon general medical questions are scarcely more than conjectural; there is limitless material upon which to work, great physical suffering to be relieved, serious economic losses to be lessened; much preventive medicine to be inaugurated. To the man whose mind it attracted by the solution of mechanical problems there is abundant opportunity for the exercise of that faculty. To him whose interest lies in surgical technic there is nothing more fascinating than the solution of the problems of tendon plastic, arthroplasty and bone transplantation; if morbid anatomy is the attraction there is a rare opportunity for the one who shall find the key to unlock the mysteries of the pathology and bacteriology of chronic nontuberculous arthritis. If sociological and humanitarian appeals come closest the heart there is no class of patients who are more in need of intelligent social service than the crippled. Industrial education for these unfortunates is coming more and more to the front and is claiming the best efforts of many well-trained men. In the wide field of internal medicine where diseased conditions in their broadest effects call for the skilled observer there is a distinct place for him whose training has cultivated habits of patience and perseverance and whose knowledge of the mechanics of the human body enables him to see in it something more than a chemical retort or a culture medium.

The sciences fundamental to medicine should be the hand maids of the orthopedist. Anatomy, human and comparative, must be constantly in his mind. Physiology cannot be relegated to the realms of the things forgotten at the end of one's first year's medical study. The problems of digestion assimilation, innervation and circulation are of frequent occurrence in the daily routine of the orthopedic surgeon. Chemistry and physics, if they too be not forgotten, may furnish the solution of many a knotty question. From this it is easy to see how one who is looking for opportunity, the instruction of his fellows or the gratification of his own intellectual aspirations, may find it.

He is remiss in his duty who fails to take advantage of the opportunities that this rich field offers and he falls short of the goal who does not in his teaching lay broad and deep in the minds of his students the possibilities that the study of these subjects opens up.

Together with many others it was my privilege to be initiated into the study of orthopedic surgery at the time that the specialty was getting on its feet and systematic instruction was just beginning in most of our larger schools. It was my further privilege to enter upon this work under the tutelage of one of the pioneers of the specialty. Those who are old enough to realize the advantages enjoyed now by those who desire to study the subject as compared with twenty years ago, one might indeed say even ten years ago, is in a position to appreciate what these pioneer workers in a new field have done for every one who has interested himself in orthopedics as a student, a teacher, or only as a general practitioner or surgeon to whom orthopedics makes an occasional appeal. Indeed I should go much farther in estimating the influences set in motion through their efforts and say that practice had been made far better outside the narrow limits of specialization as well as within them.

No reference has been made here to other educational developments in orthopedic lines such as the industrial schools for crippled children. To go into that development would be carrying us too far and that may all be gleaned from a recent article by MacMurtrie in the *Journal of the American Orthopedic Association*, Vol. IX, No. 4.

Enough has been said to make clear the importance of the work which has to be done to lay the foundations and build up the superstructure of this specialty. Of all this work, that which has had to do with the furnishing of inspiration to others as well as being the medium through which they acquired the mere technical details of their craft has been the most important. One could not work with those early engaged in developing orthopedics as a specialty without being fired by their inspiration and it is the pleasure as well as the privilege of all who had the advantage of such personal contact to pay what tribute they may to the sources from which they received their incentive.

XXIV.

AN ORTHOPEDIC VIEW OF THE TREATMENT OF FRACTURES.

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In an article on fractures written by an orthopedic surgeon, it is natural that the subject should be treated rather from the point of view that every fracture is potentially a deformity, and if it becomes a deformity will lead to impairment of function.

The object of treatment is the restoration of complete function with least risk and inconvenience to the patient and with least anxiety to the surgeon.

In attaining this object a clear idea is needed of the disabilities and deformities most likely to occur after fractures in each particular region, and also of the difficulties in treatment peculiar to each.

The smooth working of a limb depends on preserving the true axis of movement of the joints, so that the stresses of muscular action may act across the joint in normal lines. Otherwise, abnormal stresses will produce abnormal strains for we are dealing with living bone, in accordance with Wolff's law, which is the physiological equivalent of that universal law: Strain is proportional to stress.

In dealing with fractures of the shafts of long bones the first consideration therefore is to secure and maintain a true anatomical alignment of the bone, so that the axis of movement of the joints at the two ends of the bone may retain their correct relative positions. The best results are naturally obtained when the fragments at the seat of fracture are brought into correct reposition. Experience, however, has proved that meticulous exactness in replacing every fragment is not necessary to a perfectly good functional result.

In carrying out this principle of treatment every surgeon must frame for himself his own rules of procedure, being governed by his own experience of success with manipulative methods or with direct operative attack on the seat of fracture and applying splints immediately on the bone in the form of plates and screws. Those who have a large and varied experience of the manipulative treatment of deformity will probably have greater confidence in their ability to deal with deformities resulting from fractures by manipulation and external splinting. They will reserve direct operation for those cases in which they have found that their manipulative skill has not proved equal to retaining the limb in a correct position until union of the fragments has taken place.

In referring to particular fractures, the writer will therefore be drawing on his own experience with his own methods of securing that correct alignment which is the first object of every surgeon when called on to treat a fracture of a shaft of a long bone.

In this connection, it is not amiss to say that the virtue of a splint lies not so much in its particular form, but in the way in which it is used. At the same time every workman carefully selects the tools he uses and has his favorites among them. In this respect the author is conscious that he has his favorite splints, but believes that for the purposes for which he uses them, and in the way in which he employs them, they are the most suitable, most efficient and most immediately available that he can find.

It is sometimes stated that the object of a splint is to keep the parts immovable. While this is true, it is desirable to remember that the first object is to maintain the alignment. For this purpose the traditional wooden board, still often used, is not the best and is often a trap for the unwary practitioner. No human limb will fit a flat board. If a limb is bandaged to a flat board firmly enough to make it immovable, the parts above and below the fracture may easily be put out of alignment. Of this, the treatment of fractures of the femur with the long Liston splint, has furnished many examples. A further objection is that a cylindrical limb only touches a flat splint along a line. Thus, if the bandaging be really firm there is a risk of undue pressure atrophy along this line. If thin metal is used (sheet iron of the same thickness as 24 wire gauge) this trouble is very largely overcome, and sheet iron can be got from the village smith as easily as a plank from the carpenter. Sheet iron of this thickness can easily be twisted or squeezed by hand to fit the varying curves of the limb, and yet being gutter-shaped, is quite rigid longitudinally Further, having a curved cross-section and being slightly flexible, it distributes the pressure more evenly round the limb and not along a line. Hence the limb can be really firmly bandaged to the splint without fear of producing pressure sores. Of course in both instances the hollows in the limb must be suitably padded to avoid pressure on bony prominences, but in the case of thin metal splints this is much easier.

In dealing with fractures near joints or involving the articular ends of bones, difficulties of treatment are greater.

True alignment, especially of the axis of movement, is still of paramount importance, but there is also the difficulty that small fragments of displaced bone which would be of little importance in a fracture of the shaft, may here get in the way and effectively block movement by their mechanical obstruction.

The ends of long bones consist of cancellous bone containing red marrow. They are extremely vascular, and ready to undergo growth changes on very slight provocation, hence any conditions which maintain local irritation will tend to increase the amount of new bone formation with consequent obstruction of movement.

In purely traumatic cases these changes are known as traumatic osteoarthritis, but they arise chiefly from undue irritation by movement, occurring in the stages of repair. At this time, the area is more vascular than normal and the whole osseous structure of the part is therefore more susceptible to strains arising from stress of weight carrying. Examples of this will be found notably at the ankle and hip. Another factor is the stress of muscular action which, of course, is a factor in all cases, but in the upper limb it takes precedence of gravity.

This leads us to the consideration of the fact that muscles and tendons cross the joint and are often attached to the ends of the bone near the joint. They may be the surgeon's worst enemies or his best friends in the treatment of a fracture about or involving a joint, according to whether he uses them correctly or wrongly. As an illustration of this point no joint serves better than the elbow. At one time it was customary to attempt treatment of fractures about the condyles of the humerus, which are so common in children, on a right-angled internal splint. Frequently the result was a "gun-stock" elbow with the lower end drawn backward, often also displaced outward by pressure of the splint on the internal condyle, while the lower end of the upper fragment of the humerus projected forward, helping with its associated callus to produce a complete mechanical obstruction to flexion. Here, once the backward displacement of the lower fragment has begun, the triceps tendon will keep pulling the olecranon back and up. Any play means a see-saw struggle between the biceps and brachialis anticus and the triceps, with a continuous slight irritation of the part and a maximum formation of exudate and of osteogenetic formation in that exudate.

Now that these fractures are almost universally treated in the fully flexed position, the tendon of the triceps forms a comfortable, close-fitting posterior splint, any fragments in front are pushed out of the way and mechanical block to flexion cannot occur. The joint can be kept at complete rest without any play and therefore disturbing reflex contractions of the muscles do not occur, and fractures of this type have ceased to have terrors for the surgeon.

When absolute rest from movement is to be insisted on as a condition necessary for reducing the formation of obstructive callus to a minimum, some rule must be formulated to guide the surgeon when movement of the joint is again to be resumed. Here the old rule laid down by Owen Thomas can be taken as the first guide, namely, that a joint which is tender to palpation is not ready for movement. This tenderness means that excessive vascularity is still present in the bone, surrounding periosteum and tissues, and therefore that any attempt at movement will certainly injure the parts, producing fresh exudate and exciting increased formation of callus.

When this tenderness has entirely disappeared the joint may be moved through a small range of 5° or 10°. If this can be done without pain, a good prognosis may confidently be given. The patient may then be allowed to use the joint through a small range of movement, and if in two or three days the range of movement is increasing, then greater freedom may be permitted. If, however, the joint becomes stiffer and a little painful, then the time for movement has not yet come. A little later comes the time for passive movement. The indication for this is the belief that further movement is prevented by fibrous adhesions and shortening of ligaments. Passive movement should be done once in each direction in which movement is limited. It should not be followed by a reactionary swelling and stiffness which lasts for more than twenty-four hours. If the joint is stiffer twenty-four hours after a single movement it means that it is still not ready for movement, or the movement used has been too violent. To and fro passive movements are very likely to stir up a reaction of an inflammatory nature which leads to more effusion and more adhesions. In all such cases more time is lost by being in a hurry than by waiting a little longer than necessary before trying to restore motion.

So far we have said nothing of massage. At all stages of treatment we believe that massage is beneficial, provided it is of the lightest possible character and applied with skill without disturbing the fragments, or stimulating the young callus to fresh overgrowth. When in doubt on this point, it is certainly safer not to massage but to rely on absolute rest.

As we shall see when dealing with mal-united fracture, young callus is very susceptible to irritation by shearing forces. Continued pain and tenderness is the great symptom indicating that the repair has not been allowed to become firmly consolidated before the stresses of muscular action or of gravity have been allowed to act on it thereby keeping up irritation.

NONUNION AND MALUNION.

It is true that there are certain conditions of disease and constitution which retard the union of fractures. The age of the patient is certainly not a direct factor in the production of nonunion, for the most perfect union may occur in the aged and feeble. Setting aside a few cases in which there is some actual condition of disease, experience shows that nearly all cases of "nonunion" are really cases of "delayed union."

This introduces the question of the time it takes for the fracture of any given bone to unite and consolidate. In textbooks of surgery definite periods are stated for each, but these are quite unreliable. The period necessary for the complete union and consolidation of a fracture varies in every individual and is a "personal equation" to which sufficient attention is not paid. Not only cases of nonunion, but as we shall see, cases of malunion are frequently due not to any fault in the method of setting or fixing the fracture but to the fact that in the individual patient union is slow, requiring twice or even three times the usual period.

Too often the practitioner is hasty in his judgments in this matter. The fracture he is treating shows no evidence of union at the time he expects it, instead of waiting for a week or two he proceeds to disturb the parts, rub the ends together and start afresh. Again at the appointed time there is "nonunion." When these cases are ultimately sent to consult the writer his usual practice is simply to begin again and wait. By this time there has been a great deal of fibrous repair, and osteogenetic repair has failed. The first thing, therefore, is to wake up the region of the fracture by rough handling to "freshen the ends" of the bone. In doing this, the procedure called "hammer and dam" by Owen Thomas is most effective. After hammering the whole region of the fracture with a padded or India-rubber mallet, a tight elastic band is applied both above and below the fracture at a distance of several inches. This allows the limb in this part to swell to much more than its normal girth, expanding all the capillaries and lymph paths in the fibrous tissue and allowing a new process of repair to start.

This method of passive congestion was employed by Owen Thomas fifty years ago long before passive congestion as a means of treatment had attained its present prominence.

The fracture is set in the usual way and repair is expected in a longer or shorter time. In those cases where the processes of osteogenetic repair are naturally slow nothing is gained by operation, for even after plating the repair process is a delayed one.

In some cases of complicated fracture in which tissue has intervened between the fragments, open operation may be called for, but in the writer's experience the majority of cases of "nonunion" are really unrecognized cases of "delayed union."

Malunion is a large and difficult subject, and while some generalizations can be made, the exceptions are numerous. First of all there is a type of malunion which is closely related to the question of delayed union. A patient with a Pott's fracture receives skillful treatment, the foot is kept well inverted, at the end of six weeks repair in good position is pronounced complete. For six weeks the patient goes gently and then recovering confidence takes more violent exercise. After that he begins to complain of pain about the ankle and appears to be getting flat-footed. When the surgeon runs his fingers down the fibula he finds tenderness at the seat of fracture. The new bone or callus has been strained, a reaction has set in, the callus is soft and tender, the fibula is bending at the seat of fracture and the foot is being forced by body weight into the valgus position. All the treatment necessary is to invert the foot by raising the inner side of the heel of the boot, so as to alter the line of the body weight. If the patient is heavy it is as well to add an outside brace and T strap. This frequently occurs in adults, but its nature is not always recognized. The same thing frequently occurs in children in fractures of both bones in the leg, but in this case the deformity is obvious. Similar straining of the union takes place in the forearm, leading to limitation in pronation and supination; also at the hip after fractures about the femoral neck often leading to obscure "rheumatic" pains. In every case the trouble is due to straining or shearing of the callus producing an erroneous alignment and throwing the joints out of true. Bearing these facts in mind, it is wise to protect a fracture, especially of the lower limb, from undue stress, even after it appears to be firmly united. On the other hand, it is to be remembered that physiological use is the best agent to assist in making the union solid. It is therefore good practice to let the patient walk as early as possible with a protecting brace for the leg (in a Thomas walking calliper if the fracture is in the femur) or if preferred in an ambulatory plaster splint.

There are other more gross cases of malunion which arise usually from failure to get the fragments into good position when reducing the fracture, or from failure to maintain the parts in good position after it has been reduced.

In some cases it is extremely difficult to get good position or good function on account of complicating injuries. Such cases must be met by the ingenuity of the surgeon as they arise. In consequence of this difficulty, there is a growing tendency to operate and plate fractures which seem to present difficulties. It must be remembered, however, that efficient bone operations require a considerable degree of special skill, and that an open operation over the seat of a fracture is necessarily a serious consideration to the patient.

It is possible to prevent many of the common forms of malunion with their associated disabilities, by anticipating them in the methods of setting. Some of these will be described in the brief survey of the principal fractures of the bones of the limbs which will be given in the end of this article. Many methods of manipulative treatment which are traditional can be improved on, and by improving our manipulative skill and technic we may hope to frequently avert the necessity of operating.

Similarly it is to be remembered that tenderness at the seat of a fracture is an indication that the callus is not yet hard. It may therefore be broken down by manipulation and the deformity directly reduced, or it may be corrected by splints or by fixing the limb in a corrective position, just as one can correct a bow-leg or knock-knee by splints, or an active case of coxa vara by extension in the abducted position.

The time that has elapsed since the accident is no indication of the solidity of the union. If the seat of the fracture is tender the callus is soft. Usually the patient complains also that the deformity is growing worse, that is to say, the callus is yielding. If it can yield in the direction of deformity, it will yield with equal readiness in the direction of correction if proper forces are applied to it.

Turning now to a brief review of the commonest fractures:

Fractures of the Clavicle.—Fractures of the clavicle are generally well treated, for it is recognized that the general alignment of the bone must be well maintained by keeping the shoulder back and out. The bone is subcutaneous and the practitioner can see and feel the position of the fragments.

Fractures of the Humerus.—In fractures of the neck of the humerus the seat of fracture is deeply situated in muscles and we must be guided by experience.

Dissections and radiographs teach us that in malunions the upper fragment is frequently abducted and the lower fragment becomes united to its lower side. Clinical experience teaches us that the disabilities which are of greatest practical importance to the patient are limitation of abduction and of external rotation, so that he cannot place his hand at the back of his head.

In reducing this fracture it is often useful to have an assistant extend the limb downward till the fragments clear, then outward to a right angle with the body, and even straight upward by the side of the head. Meanwhile the surgeon with his hand in the axilla and on the arm can feel that the rough broken surfaces have engaged. The arm can then be gently brought to the side, and the arm fixed to the side in the usual manner. There seems to be little fear of the ends disengaging once they are properly apposed.

When union is sound, passive abduction and rotation once a day will soon reestablish a full range of movement.

When a case comes to me with a stiff shoulder and a limited range of movement, I place more reliance on passive movement, breaking down adhesions first under an anesthetic if necessary.

After fracture of the neck of the humerus, forcible breaking down of adhesions in the shoulder-joint should not be attempted for at least three months, as refracture may occur. During the operation the surgeon should remember that the movement most dangerous is not flexion, but internal and external rotation. In the meantime, an assistant should hold his fist firmly in the axilla to prevent dislocation.

In addition to his daily passive movements, he should practise reaching up the wall with his fingers, making a mark each time at the limit of his stretch and being careful to surpass it at his next attempt. I have been much struck by the extremely serviceable range of movement obtained by these means.

The so-called fracture of the surgical neck which usually includes both tuberosities with the head is really less troublesome. It occurs usually in old people and is often impacted. In these cases the arm may be left quietly by the side and a very useful range of movement can be obtained by exercise and passive movement later.

Fracture of the surgical neck complicated by dislocation is much more serious. The maneuver which I have found most useful is that already described of having the arm stretched straight upward by an assistant while the surgeon endeavors to manipulate the head back into position. If this fails, operation may be resorted to, and McBurney's hook is of great service in twisting the upper fragment into place.

Fractures of the shaft of the humerus may be troublesome from two causes—either on account of damage to the musculospiral nerve through injury or inclusion in callus, or due to nonunion, the latter being generally caused by inefficient fixation. Many cases of supposed permanent damage to the musculospiral nerve are cured in a few weeks by application of a splint which holds the wrist in dorsiflexion. The patient generally goes about from the beginning of treatment. There is not room for the thick splint frequently employed to lie comfortably in the axilla between the patient's arm and the body, and hence the arm is not as firmly fixed as it should be. Sheet metal splints occupy very little space. The best method I know of setting these fractures, especially when working single-handed, is the following: First get ready three sheet-metal splints. The external one extends from the external condyle to well above the shoulder and its upper end is bent over to form a sort of shoulder cap. A short splint extends from above the internal condyle to the anterior fold of the axilla, and a similar posterior one to the posterior fold of the axilla.

Flex the elbow to an angle of about 60° and sling the wrist to the neck, with the patient sitting in a chair. A loop of bandage is put round the flexure of the elbow and does not reach the floor. By putting one foot in this loop, the surgeon can apply as much extension as he chooses, while both hands are free to manipulate the fractured ends into correct position. The splints are applied and squeezed up till they fit closely around the arm. A turn of sticking plaster now binds them into a cylinder fitting the arm. A sheet of wadding is then placed between the arm and the chest. The whole is secured with a broad bandage carried over the shoulder and the part of the external splint which is turned over like a shoulder cap. This prevents shortening, for the lower end of the cylinder fits round the arm above the condyles.

As the whole arm is in a close-fitting cylinder displacement cannot easily take place, and the patient is quite comfortable.

Except to free the musculospiral nerve from callus operation is rarely necessary, for even if there is some overriding of fragments a little shortening of the arm does not give rise to any serious impairment of function to the ordinary man.

All fractures through the condyles and indeed all fractures about the elbow, except fracture of the olecranon, are best treated in the fully flexed position. For the first few days the forearm, fully supinated, should be bandaged to the upper arm in fullest flexion, after this it is sufficient to keep the wrist slung short up under the chin.

In dealing with cases of stiff elbow after fracture through the condyles, especially in children, even if there is backward displacement of the lower fragment, I always first attempt to secure full flexion.

Under an anesthetic, with the humerus and forearm protected by local plints, the elbow is forcibly flexed, breaking or twisting the recent callus. The arm is then bandaged in the most flexed position obtainable. It is a remarkable fact that callus in front of an elbow-joint when subjected to continuous pressure in this way is rapidly absorbed, so that in a few days the elbow can be further flexed.

If necessary, the process may be repeated a second or third time till nearly complete flexion is obtained. The elbow is then left fully flexed till all reaction has disappeared. Then a gradually increasing range of movement is permitted, as has been already described.

Of course this treatment is not applicable to a case with actual bony ankylosis between the humerus and bones of the forearm, but such ankylosis is really very rare. If you can once get the callus on the move the progress toward recovery only requires about six weeks in the majority of cases.

In fractures of the shafts of the bones of the forearm the chief disability to be feared is inability to supinate the forearm completely. The trouble usually arises when both bones are broken. Here anatomical knowledge is of importance. The whole length of the posterior border of the ulna is subcutaneous and is practically straight. On this straight ulna the curved radius rotates like the handle of a bucket.

We must therefore attend to two points. First we must keep the ulna straight, second, we must not interfere with the natural curve of the radius. That is to say, there must be no pressure of bandage or splint on the middle of the shaft of the radius.

With anterior and posterior wooden splints, the middle of the forearm is often allowed to sag into a curve. Once the ulna is allowed to bend, both upper and lower radio-ulnar joints are thrown out of line. With gutter-shaped metal splints, which wrap themselves round the limb, the arm can be fixed with the ulna lying straight along the posterior splint and the radius will almost take care of itself so long as it is free to take its natural curve. This can be secured by fixing the splints at their two ends, at the wrist and elbow. When union has taken place, see that supination is possible before the callus is too hard to be twisted.

No mention is made of muscular action, because I hold that it is merely a reflex called forth by shifting of the parts. If the forearm is comfortably fixed in splints and slung across the body at right angles to the arm, there will be no reflex muscular spasms. This question of muscular spasm will be dealt with more fully when dealing with the femur.

Movement of the fingers in forearm fractures seems to do good and not harm. It does not disturb the relations of the fractured bones, and provides a healthy physiological stimulus to the circulation and general trophic condition of the limb. In fact, if the patient cannot move his fingers without discomfort. it may be taken as an indication that there is something wrong. The surgeon should then ascertain if his alignment is faulty or if there is undue pressure.

Colle's fracture and Chauffeur's fracture, with or without fracture of the styloid process of the ulna, should give no trouble provided two things are attended to—first, the reduction of the displacement, and second avoidance of strain of the callus by injudicious passive movement. The lower end of the anterior aspect of the radius is concave, with a very pronounced curve toward the prominent anterior edge of the lower articular surface. This curve must be preserved or the joint will be out of alignment, and the patient will complain of pain and stiffness until nature has had time to make necessary readjustments.

After reduction, a good anterior pad of wool is placed in the concavity of the radius already referred to, a similar posterior pad is placed on the dorsum of the wrist-joint and carpus, rather to the radial side. Firm pressure on these two pads maintains the correction.

Using sheet-metal splints the author puts a spiral twist on each. For the right arm the dorsal splint is twisted a half turn with the clock and the anterior splint a half turn against the clock. The lower end of the anterior splint should stop short with the radius and must not encroach on the thenar eminence. A turn of sticking plaster at the wrist secures the two parts in position. A second turn near the elbow secures the other ends of the splints near the elbow. The dorsal splint need only extend half way down the dorsal aspect of the metacarpals. A bandage over all makes everything secure. The patient should be encouraged to move the fingers from the first. If this be impossible the surgeon should find out why.

The splints may be left on for five weeks, for instance when a pretty result with a minimum of callus is desired in a lady's wrist. If the fracture is properly set, there is no fear of a stiff wrist.

In the author's experience, stiff wrists after Colles' fracture are due to two causes: incomplete reduction and injudicious movement producing strain of young callus. Patients with a Colles' fracture often imagine they have "only a sprain," go home and apply cold water bandages for a day or even two and then go to the surgeon with a painful swollen hand and wrist. When one of these cases appears lose no time, massage away as much of the swelling as possible and reduce at once. Delay only means increased difficulty in complete reduction, and the probability of more trouble from stiffness afterward.

The next point is that early passive movement of the wrist—not of the fingers—is apt to mean disturbance of the area of repair, and further reaction with pain and increased stiffness.

Cases with stiffness of the wrist and pain on any attempt at passive movement come for advice three to six months after the accident. There is a history that in spite of the most assiduous efforts to restore movement, the wrist has remained stiff and painful, and that the more it is moved the worse it is. In these cases a careful examination will nearly always reveal the fact that the deformity is not reduced. The presence of pain and reaction after movement is proof that the callus is still in an irritated or active condition and cannot be very hard. In such cases the author reduces with a Thomas wrench, applying the jaws of the wrench jus′ as he would have applied his own scaphoids had the case been a recent one. This operation can be done under gas. Incidentally adhesions are broken down and the fact that, when the patient wakes up with splints on, he can move his fingers as he could not do before, is a great encouragement to him.

There are other cases of malunion after a Colles' fracture of older standing, in which all pain at the seat of fracture is gone. The callus is solid but the patient cannot use his hand well. In these it is generally found that the patient cannot dorsiflex the wrist and therefore the grasp of the hand is feeble. Such cases should be treated like cases of fracture of the carpal bones —by restoring dorsiflexion.

Fracture of Bones of the Carpus.—In the carpus, the bone most frequently fractured appears to be the scaphoid. Clinically the case appears at first to be a bad sprain. A diagnosis may be made, however, by the acute tenderness on pressure in the "anatomist's snuff-box."

The great disability complained of after this and similar injuries is stiffness and weakness of the fingers. On examination this is found to be due to inability to dorsiflex the wrist. Every schoolboy knows that the grasp of the hand is weakest when the wrist is flexed and strongest when it is dorsiflexed, but surgeons have been strangely slow to put this knowledge to practical use. Stiff wrists are nearly always slightly flexed wrists, therefore the treatment is clearly to keep the wrist quiet in dorsiflexion till the storm is passed.

Having diagnosed a fracture of a carpal bone, the writer always dorsiflexes the wrist and puts it up in this position on a palmar splint of sheet metal, known for many years in Liverpool as the "cock-up" splint. If a fragment of the scaphoid is displaced backward and obstructs dorsiflexion, he first tries to press it back into position and then dorsiflexes the wrist. If this fails, the fragment should be removed at once and the wrist put up in dorsiflexion. In cases of fracture the splint need not extend beyond the palm, the fingers being free.

In cases of stiff wrist with an inflammatory element, the palmar part of the splint should extend to the tips of the fingers until the inflammation has subsided.

As has been already indicated this treatment will increase the range of movement and improve the function of the wrist in certain cases of stiffness after old-standing Colles' fracture.

Fractures of the Lower Limb.—In dealing with fractures of the lower limb, especially with fractures of the femur, muscular action has always been a disturbing factor, tending to produce shortening and over-riding of fragments.

Let it be said at once that the writer never employs weight and pulley extension. Extension by weight and pulley is a most inefficient method of attempting to control muscular spasm. It is by reflex nervous impulses induced by changes of tension in the muscle, that muscular spasm is produced. A patient lying in bed with a fractured femur cannot avoid constantly changing the state of tension of the muscles of his thigh if he has a weight and pulley attached to his limb. The counterpoise is the weight of his body. Every time he tries to shift the position of his shoulders by digging his elbows into the bed, he alters the tension on his muscles calling forth a reflex spasm. When he falls asleep and his muscles relax, when he moves in his sleep, when he is lifted upon a bed pan, or moved slightly by the nurses to have his bed put straight, there must be a reflex contraction of his muscles because there is a sudden change in tension. The muscles are always on the alert. Liston with his long splint used a perineal band and fixed the ankle down to the lower end of the splint. This form of extension was absolutely sound in principle, but was abandoned because the perineal band chafed and made the groin and perineum sore. The real reason for this was that the perineal band was cloth, absorbed perspiration, and became septic and irritating.

Nevertheless the best method of fixing the thigh is by fixed extension such as Liston used, only the method can be much improved on. To illustrate this point consider a fracture of the middle of the shaft of the femur, with extension strapping of adhesive plaster applied in the usual way to the sides of the limb right up to the seat of fracture. At the lower end of the extension strapping there is a loop of webbing to which is attached a length of strong bandage, or better still of ordinary lampwick. Next slip the ring of an ordinary Thomas knee splint over the foot and up to the groin till it is firm against the tuber ischii; pull the extensions tight; take a turn round each side bar; and tie the ends together over the bottom end of the splint which of course projects 8 or 10 inches beyond the foot. For fur her control, place behind the limb a gutter-shaped sheet-metal splint extending from the buttock fold to the lower third of the leg with a good wool pad in the hollow of the knee. On the front of the thigh place another sheet-metal splint stopping short above the patella, and fasten the two together with a couple of circular bands. This gives excellent local control for the sheet-metal splints, each embracing nearly half the circumference of the limb. A couple of little transverse bandage slings suspend the posterior splint from the side bars of the knee splint, so that the center of the limb is exactly between the two side bars. The alignment from hip-joint to ankle-joint is perfect, being dependent on a straight pull.

Now the patient may raise his shoulders. His other leg can even be moved without altering the tension on his thigh muscles, and there is no reflex spasm of the muscles. Further, even if the muscles try to contract they cannot, for the upper end of the splint is firm against the tuber ischii. The muscles, therefore, do not remain on the alert, but come to rest. Starting pains are unknown.

A little attention is necessary to prevent soreness of the perineum. The ring of the splint is covered with leather, a wipe with a soapy rag slipped between the splint and the skin keep both clean and polished. Finally the nurse must several times a day press down the skin of the buttock and draw a fresh part of skin under the splint. After a few days the patient becomes so used to the splint that this is no longer necessary, but with a very fat flabby patient, the skin may begin to show signs of redness in half an hour and should therefore be attended to every half hour for the first day or two.

Having obtained the full length of the limb, all that is needed is to keep the extensions taut. This is a very different thing from hanging a weight of several pounds on to the limb to tire out the muscles.

All that is necessary is to prevent them from contracting. If a muscle has no play it is not nearly so ready to respond to reflex impulses as a muscle which is under elastic tension.

In a straightforward case where all the shortening has been corrected when the fracture was set, or within a day or two by tightening the extensions as the muscle relaxes, there is nothing more to do until the end of the fifth or sixth week by which time fair union has taken place. Now a walking caliper a quarter of an inch too long for the limb is substituted for the bed splint, and the patient is allowed to walk. As the splint is just a shade longer than the limb he cannot quite get his heel to the ground and therefore is not really carrying weight. Swinging the limb along improves its nutrition, and generally aids in hastening the process of repair, for it is a modified form of the normal physiological function of the limb.

In dealing with malunited fractures of the shaft of the femur the same method of splinting is employed. First, however, there is the question of how to get rid of the over-riding. If there is tenderness and pain at the seat of fracture, especially if the deformity is increasing, it is quite safe to conclude that the callus is still soft even though many months have elapsed since the accident. In such a case by twisting and manipulating the limb the callus can be broken down. Then with block and tackle the muscles can be forcibly stretched as much as 2 inches or rather more at one sitting. The limb is then put up in the manner described, with fixed extension. Next day or the day after, the muscles will be adapted to their new length and by tightening the extensions an overlapping of 3 or 4 inches can readily be corrected in a few days and the limb made nearly if not actually as long as its fellow. At the same time with this straight pull, any angular deviations out of the true line are automatically corrected.

To deal with such cases, it is convenient to clip on to the bottom of the Thomas splint a small apparatus which consists of a central screw bolt at the end of which there is a little swingle bar to the ends of which the extensions are attached. As the muscles relax the nurse gives a turn to the screw and keeps the extension taut, in this way the muscles never get an opportunity of shortening, and it is astonishing to see how rapidly they relax. With this method one relies more on preventing contraction than on actually stretching the muscle by force except of course the pulling when the patient was under an anesthetic. That is very forcible. A good start means a great deal but once the bone is started to move, it can be continued without much trouble.

In cases where the callus is already solid, I operate with the limb forcibly stretched with block and tackle, endeavoring to correct the whole of the shortening there and then. If it is possible to get the whole of the shortening reduced at once, of course the next step is to fix with plates and put the limb up as already described.

Fractures of the neck of the femur are treated in a different way. The great deformity to be feared is that produced by the shaft travelling upward past the head and neck. Experience has proved that to avoid this varoid deformity the fracture should be treated with the limb in the abducted position. For this purpose, a double Thomas hip splint with the leg piece abducted is very convenient. The splint is fitted with extension bows. That is, a bow exactly like the lower end of a knee splint is attached to the ankle wings of the splint. Counterextension is by a groin strap well padded and covered with leather. This is usually put on the opposite groin, partly to avoid having pressure near the injured hip, partly because this allows the pelvis to tilt a little toward the injured side and so give a greater degree of abduction.

This apparatus and position are applicable to the treatment of all fractures above the trochanter minor whether in children or adults, of coxa vara in the active state, and of tuberculous disease of the hip. In fact, it is the position in which to treat any condition in which an adduction deformity at the hip is to be feared as a result.

It is equally suitable for the fracture of the femoral neck which occurs in infants as an obstetric injury, for the separation of the epiphysis of the head of the femur, for the strains of the neck which occur during school life, and for the so-called extracapsular fracture which occurs in young adults. It is also suitable for the treatment of intracapsular fracture in the aged, provided the patient can stand the recumbency and restraint. The least sign of hypostatic pneumonia is an indication for abandoning this method, putting the patient in a Thomas knee splint propping him up well or even getting him out of bed and making the best of the fracture. Even under these unfavorable conditions these patients can get about wonderfully well in a walking calliper even if union should fail.

The fracture in young adults is usually caused by direct violence applied to the trochanter major. It is associated with splitting and broadening of the trochanter, and often is impacted. The question of disimpacting these fractures has been much discussed. My practice is to disimpact before setting if there is rotation or if there is any material shortening. Rotation outward of the foot is a much more serious deformity than a little shortening. If the foot is in good position without any outward rotation and the shortening is not more than might reasonably be expected in any case, then it is not necessary to disimpact.

As already stated, I treat all fractures above the trochanter minor in abduction and all fractures of the femur below this point on a Thomas knee splint. The alleged disturbing action of the psoas muscle in my experience does not occur. This is to be attributed not necessarily to errors of observation on the part of those who report it, but to the fact that with fixed extension, reflex contractions of muscles do not persist. I do not believe that the desire to contract, unless it is oppressed, is as inherent in muscle as if it were original sin. My whole experience in the treatment of fractures, as in the treatment of such conditions as spastic paralysis, is that if muscles are efficiently controlled they come to rest and cease to struggle, but that if the control is inefficient or intermittent then reflex action is active and all muscles enervated from the same region of the cord share or less in the excitability.

Similarly it is my experience that in supracondylar fracture of the femur the lower fragment is not flexed by the action of the gastrocnemius after the first twenty-four to thirty-six hours, provided the limb is efficiently controlled. One of my former house surgeons has told me of a case in which he had direct ocular proof in a case of compound fracture in which the bone was exposed. He saw the bone gradually return into line with the femur by the end of the day after the accident. After this the wound began to granulate and no more was seen of the bone. The functional result was excellent.

Of fractures of the leg there is little to be said until the lower fourth of the leg is reached. Fractures above this are comparatively easy to handle, even if both bones are broken, but in my experience fractures of the lower fourth of the tibia or of both bones in this region are extremely difficult to control even if the tendo-achilis be divided. The slightest error of alignment may mean constant pain and weakness in the ankle for months afterward.

Although I approach most other fractures with a feeling of confidence that I can treat them successfully by manipulation, I feel that in fractures of the lower fourth of the tibia and fibula operation is usually the wisest course for me. My usual practice is to attack the tibia If it is secured with plates and screws the fracture of the fibula can usually be dealt with by manipulation.

I have frequently seen a wedge of bone knocked off the anterior and outer part of the lower end of the tibia. This may occur by itself or as a complication of a Pott's fracture. The detached fragment is liable to slip down a little and block dorsiflexion and therefore interferes with walking. The treatment in the first instance is to get the foot into extreme dorsiflexion thus pushing the fragment out of the way. If the foot is fixed in this position for a few days the condition will not recur. In old-standing cases, the patient comes with a history of an injury to the ankle or of a fracture in that region, and complains of pain over the front of the ankle-joint. On inspection the foot seems rather fuller than its fellow in this region. The X-ray photograph shows some irregularity of outline chiefly due to irritation periostitis. The treatment is to operate, removing the offending portion of bone and making sure that the foot can be completely dorsiflexed. If the patient declines operation, then the only thing to be done is to raise the heel of the boot so that the front of the astragalus does not impinge on the front of the tibia when walking.

There has recently been a great revival of interest in the treatment of fractures, stimulated by the revelations made by radiography, by the comparative impunity with which modern operative procedures can be attempted and by a growing dissatisfaction with the functional results frequently obtained by traditional methods of treatment.

In a single short article it is manifestly impossible to do more than touch on the fringe of so vast a subject.

The question before the modern surgeon is not whether operative treatment is to supersede manipulative. The problem before each of us is how can we improve our skill and technic in both manipulative and operative treatment, and what means must we adopt in each individual case to give to our patients the surest, safest, and most complete restoration of function?

CLINICAL DEPARTMENT.

XXV.

A METHOD OF OSTEOTOMY OF THE LOWER END OF THE FEMUR IN CASES OF PERMANENT FLEXION OF THE KNEE-JOINT.*

BY R. B. OSGOOD, M. D., BOSTON.

(From the Orthopedic clinic of the Massachusetts General Hospital.)

The range of usefulness of the operation to be described is realized to be small, but perhaps definite. It is believed to be applicable to those cases of permanent flexion of the knee-joint in which a useful degree of free voluntary flexion is possible beyond the point of permanent flexion. In other words, in cases of long standing when complete extension is lacking and the contour of the joint suggests that there is little likelihood of its being regained without an osteotomy of the lower end of the femur. Such cases are those following joint inflammation or chronic disease of any sort in which deformity has not been prevented and in which the joint surfaces have been so changed as to make it doubtful whether useful motion in extension can be regained even by complete division or lengthening of the ham-string tendons and the gradual stretching out of the posterior capsule and vessels and nerves.

Such cases one also occasionally meets as the results of old fractures near or into the knee-joint. Under these conditions a cuneiform osteotomy of the lower end of the femur as near the joint surface as possible would seem to be the operation of choice. Unless a wedge of bone is removed the tension on the vessels and nerves is often too great to allow complete straightening even if the ham-strings are divided. When a wedge is removed by the ordinary method it is sometimes difficult to avoid injury to the upper cul-de-sac of the knee-joint when one goes as near the articular surface as is desirable. It is always difficult to control the position of the small lower fragment without the application of a bone plate, owing to the subsequent spasmodic pull of the heads of the gastrocnemius. This has long been recognized in accidental fractures in this region.

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* Read before the American Orthopedic Association, May, 1913.

To overcome these possible difficulties the following operation has been usefully employed by the writer in three cases and by his associate in the Clinic, Dr. Harvey Newhall, once. In his hands it has apparently been equally applicable. A paper tracing pattern of the bones is first made from the X-ray print and an accurate idea obtained of the dimensions of the wedge necessary to be removed to gain full extension. A 2-inch linear incision is made on the outer side of the leg, posterior to the edge of the upper cul-de-sac of the of the knee-joint, and extending upward from about the level of the upper border of the patella. This incision is carried down to the bone and with a blunt dissector a space is cleared over its upper surface. A second incision is then made at the same levels on the inner side of the femur and a similar space cleared beneath the cul-de-sac over the upper surface of the femur joining the space made through the outer incision. The flexible blade of an ordinary coping or jig (Fig. 1) saw is now pushed through, teeth down, in the path made by the blunt dissector and inserted in the arms of the saw, the blade passes over the top of the bone beneath the upper cul-de-sac. The first cut is made forward and slightly toward the posterior surface of the bone (Fig. 1, *AB*), toward the lower end of the femur for about three-quarters to an inch, and then inclined sharply downward, *i.e.*, toward the posterior surface of the femur backward, that is, toward the upper end of the table (Fig. 1, *BC*). When the posterior cortex has been partially sawed through the arms of the saw are removed and the detached saw left in as a marker for orientation. A second saw blade, teeth downward, is now passed through the path above the bone and made to engage it above the entrance of the first saw, depending upon the size of the wedge required. A cut is now made in a straight line down to the position of the first saw (Fig. 1, *BC*) and both saws removed. Thus a quadrilateral portion of bone (Fig. 1, *ABCB*) is freed which is pushed out through one of the incisions. Extension is then made and either a green-stick or complete fracture of the posterior cortical shell is made, while the lower end of the upper fragment is forced against the upper end of the lower fragment whose projecting upper lip made by the first saw cut keeps it from displacing backward and apparently quite firmly anchors it. (Fig. 1.) One may remove a little of the anterior surface of the upper fragment and so bring everywhere raw bone to raw bone. After closure of the wounds a plaster dressing is applied and in our cases union has apparently been firm in from four to six weeks.

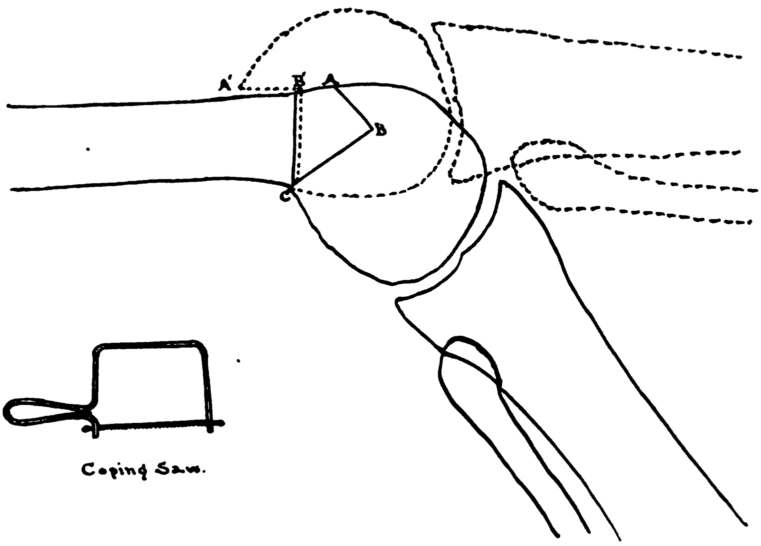

Fig. 1.—Line drawing of carpenter's coping saw and diagram of operation. Saw entered at *A*, carried to *B*, and thence to *C*. At *C* saw removed from jaws and left here for orientation. Fresh saw entered at *B'* and carried to *C*. Quadrilateral piece *A B C*, *B'* pushed out. Leg straightened bringing *A* to *A'* and *B* to *B'*.

Case I.—W. J. W., aged twenty-one, single, male.

Family History.—Unimportant.

Previous History.—Only known disease, measles when a young child.

Present Illness.—There is an indefinite history of a swollen and acutely painful right knee joint when he was about three years old (acute epiphysitis?). Since the patient can remember he has always used a crutch and never borne weight on the right leg, which has been smaller and drawn up at the knee. He has had no acute symptoms since the original trouble and has had no medical advice. He seeks advice as to the possibility of gaining weight-bearing power in the right leg.

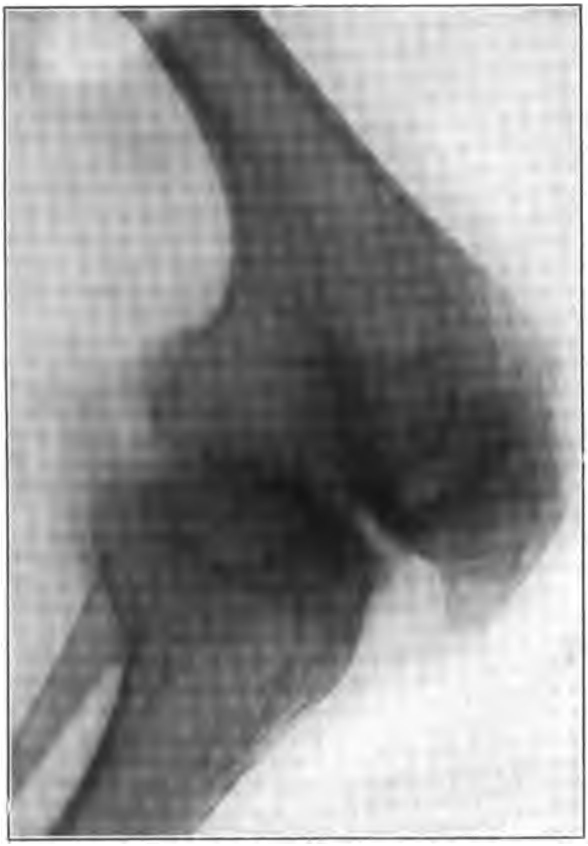

FIG. 2.—Case I. Before operation. Old epiphysitis, 20° of motion remaining in flexion. Marked retardation of growth.

Physical Examination.—General examination negative. Right leg permanently flexed at knee about 45 degrees. Patella slightly movable. Motion in further flexion 20 degrees. Much atrophy and total shortening of about 4 inches, mostly below the knee.

Admitted Sept. 15, 1911, to the Orthopedic Ward of the Massachusetts General Hospital. From a paper pattern of the bones made from a tracing of the skiagraph, the necessary extent of bone removal to gain extension was determined.

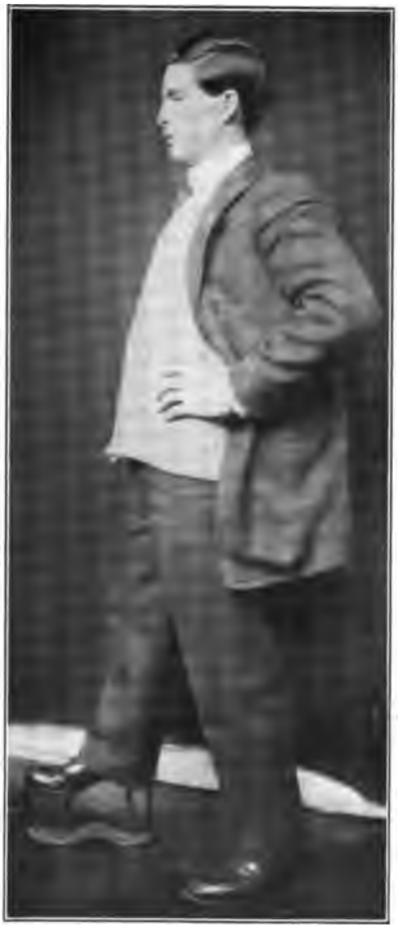

FIG. 3.—Case I. After operation. Old epiphysitis. Standing position. Forward step of short leg.

Sept. 18, 1911. Operation. Tenotomy by open incision of the hamstrings. Osteotomy by coping saw and removal of quadrilateral piece of bone through short lateral incisions was performed. (See description of operation.) Plaster-of-Paris bandage, groin to toes, applied with leg in extension. First intention healing. Uneventful convalescence. Discharged to convalescent home, Oct. 14, 1911.

Case examined eighteen months after operation. Result excellent. Twenty degrees of motion in flexion remaining. Nearly complete extension. With a pattern on the shoe the patient is walking well, using a cane most of the time, but able to stand and walk without support. See Figs. 2, 3, and 4.

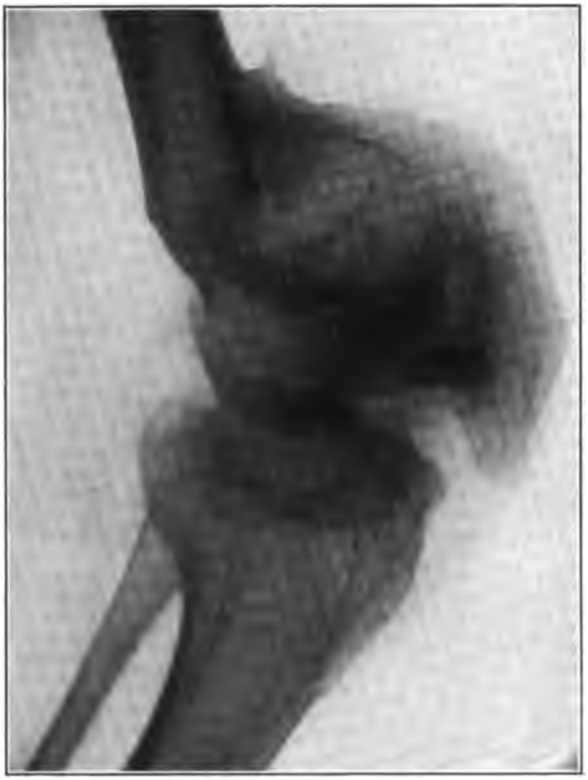

FIG. 4.—Case I. After operation. Old epiphysitis 20° of motion in flexion nearly complete extension. See Fig. 3.

CASE II.—E. P. R., aged nineteen, single, male.

Family History.—Unimportant.

Previous History.—Frequent attacks of tonsillitis.

Present Illness.—The patient had a typical attack of poliomyelitis when four years old involving chiefly the right leg. In spite of treatment he gradually developed a knee contracture in flexion and a knock knee of considerable degree.

Physical Examination.—The nutrition of the limb was very poor, the circulation was very sluggish, and the atrophy extreme. There was no useful power below the hip except slight voluntary contraction of the hamstrings. There was permanent flexion of 40 degrees with a change in the contour of the femoral condyles. On account of the poor nutrition it was not thought wise to use force in correction of the flexion and knock-knee. The operation described above was therefore undertaken.

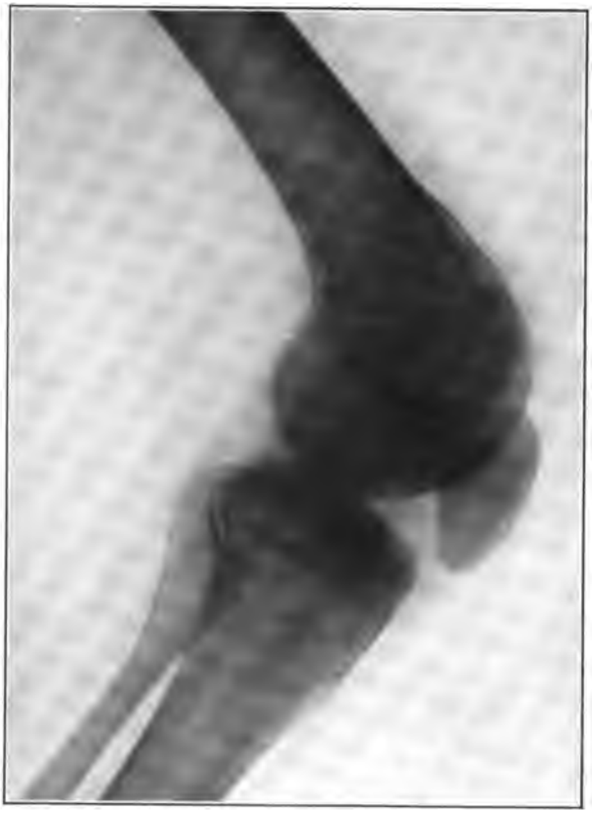

FIG. 5.—Case II. Before operation.

Admitted Dec. 18, 1911, to the Orthopedic Ward of the

Massachusetts General Hospital. From a paper pattern of the bones made from a tracing of the skiagraph the necessary extent of bone removal was determined.

Jan. 2, 1912. Operation. Osteotomy by coping saw and removal of quadrilateral piece of bone through 2-inch lateral incisions (see description of operation) was performed. Plaster-of-Paris bandage toes to groin applied with leg in extension and with correction of knock-knee. First intention healing. Uneventful convalescence. Discharged Feb. 3, 1912, to Out-Patient.

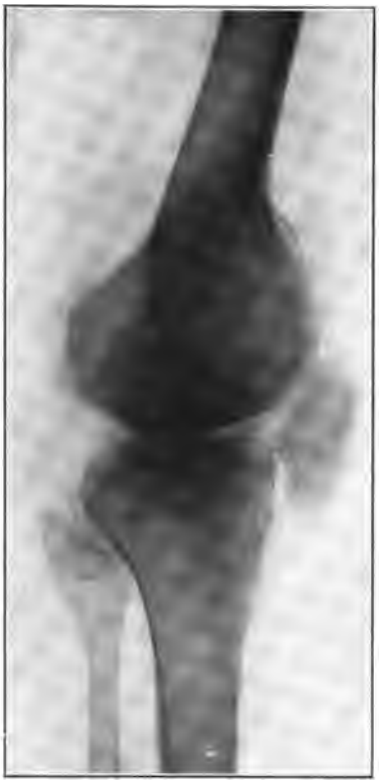

FIG. 6.—Case II. After operation.

Case examined one year after operation. Correction has remained permanent. See Figs. 5 and 6.

CASE III.—M. E. McD., aged twelve, single, female.

Family History.—Unimportant.

Previous History.—Unimportant.

Present Illness.—On Jan. 10, 1912, the patient received an injury to the right knee in a coasting accident, for which she was treated for eight weeks by her family physician for water on the knee. She was then brought to the Massachusetts General Hospital, where she was seen in the Surgical Out-Patient Department, and an old fracture with firm union made out by the examination and X-ray. There was 35 degrees of permanent flexion. She was treated in the Zander Department for several months in the hope that more extension could be gained.

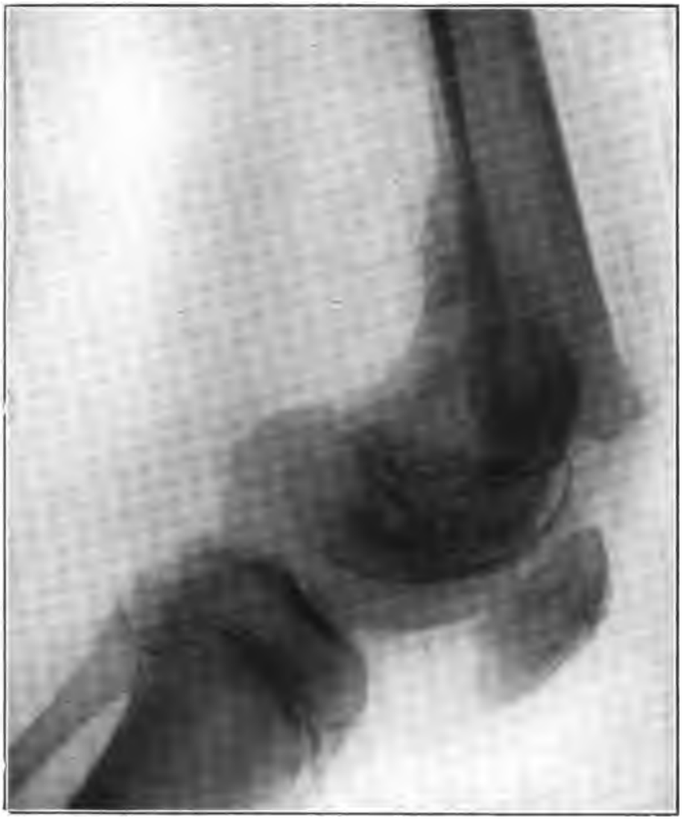

FIG. 7.—Case III. Before operation. Old fracture of lower end of femur. 45° permanent flexion. Free flexion beyond this point.

There was, however, little gained, and in July, 1912, she was referred to the Orthopedic Department. The Physical Examination at this time showed 148 degrees of extension, 1/2 inch shortening, full flexion, no tenderness, firm union. X-ray (Fig. 7) showed marked displacement with over-riding of upper fragment.

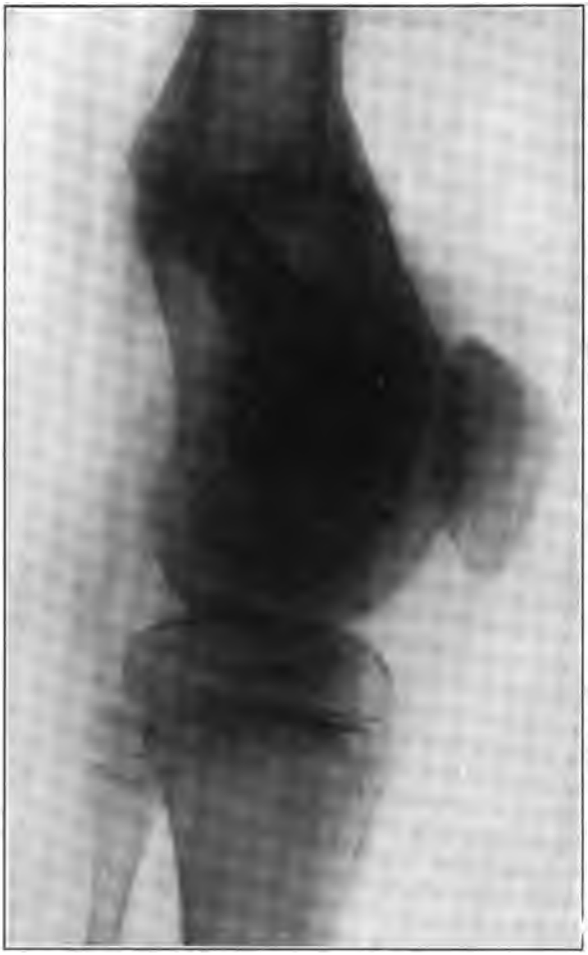

FIG. 8.—Case III. After operation. Lateral view. Full extension. Flexion to beyond a right angle.

Admitted July 19, 1912, to the Orthopedic Ward.

July 25, 1912. Operation. Osteotomy by a coping saw, and removal of a quadrilateral piece of bone through lateral incisions. Projecting portion of upper fragment removed with osteotome. Complete extension gained Plaster-of-Paris bandage groin to toes. First intention healing. Uneventful convalescence.

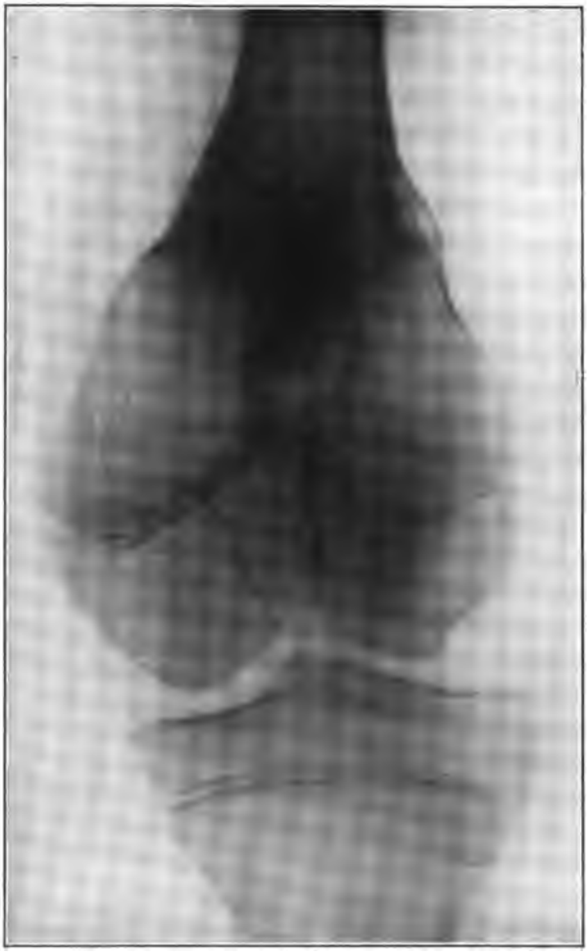

Fig. 9.—Case III. After operation. Anterior posterior view.

Discharged Aug. 31, 1912, to Out-Patient Department.

Seen nine months after operation Voluntary flexion to beyond a right angle. Complete extension. No subjective symptoms. See Figs. 8 and 9.

XXVI.

DURALUMIN, THE NEW ALLOY FOR ORTHOPEDIC APPLIANCES.*

BY JAMES K. YOUNG, M. D., PHILADELPHIA.

In a recent lecture by E. Murhead Little of London,† attention is directed to a new material (duralumin) for surgical appliances, which appears to possess qualities rendering it particularly useful for orthopedic appliances. This alloy of aluminum was produced by Messrs. Vickers Co., Ltd., London, for use in aeroplanes, airships, churches, etc., etc. Various metals have been used for the manufacture of surgical appliances from time immemorial; the process of tempering steel having been described by Homer, and a steel implement used over 5000 years ago in the construction of the pyramids at Kephron in Egypt has recently been discovered.

The weight of steel has always been an objection to the use of this metal and when aluminum was first produced in commercial quantities it was hoped that this metal would supplant steel for use in orthopedic appliances. Its brittleness, instability and its perverse qualities were soon discovered and it had to be reenforced by brass, bronze and other metals.

Duralumin.—Duralumin resembles aluminum in general physical appearances, but is harder, tougher, and more durable than the latter. It is nearly as light as aluminum and as strong as soft or mild steel. One cubic inch of duralumin weighs 1.623 ounces. (D. = 2.79, alum. 2.7, steel, 8.) Its sp. gr. and its melting-point, 650° C. Coefficient of expansion for all grades of D. is .000023. It does not crystallize, is nonmagnetic and is not affected by mercury. It takes a fine lasting polish and is little affected by atmospheric influences, fresh and sea-water, sulphuric or nitric acids or sulphuretted hydrogen. It is transparent to the X-rays, and is therefore valuable for splints, and particularly for obtaining pictures of joints after reduction, as in congenital hip dislocation, and after operation for vicious union, or pseudoarthrosis. It can be tempered like steel. It can be soldered but cannot be brazed, but the annealing effect of soldering is injurious, hence should not be employed. In order to test its tensile strength I submitted samples of rods to my cousin, Mr. S. S. Young of Roeblings Wire Mfg. Co. of Trenton, N. J., and he reported that the *large piece*, duralumin .2507 inch, broke under strain of 2342 pounds which gives a tensile strength of 48,000 pounds per square inch.

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* Read by title before the American Orthopedic Association, May, 1913.

† *Brit. Med. Jour.*, Feb., 1912.

The *small piece*, diameter .1877 inch, broke under strain of 1730 pounds which gave a tensile strength of 62,754 pounds per square inch. We can therefore safely say that in rods between 3/8 and .1877 the tensile strength would run from 65,000 to 70,000 pounds.

In another test made by the Gen. Electric Co., of West Lynn, Mass., who are large users of this metal, the tensile strength of 3/8 rod was 70,000 pounds, and as the samples tested for me were manufactured at the initial stage, probably through some flaw in the sample a tensile strength of 48,000 was shown.

In the article above referred to Mr. Little speaks in the highest terms of its use for braces, and coming as this does from one so eminent in his profession it carries great weight.

The first brace was made for me about three months ago, and since that time a number have been made by Charles Lentz & Sons of Philadelphia—including spine, leg and sacroiliac belts, etc. These have proven most satisfactory in my hands on account of their lightness and toughness. The fact that this metal takes and keeps a high degree of polish renders it unnecessary to plate it. Its resistance to salt water is a particularly good quality especially in foot plates where the metal is exposed to perspiration.

EDITORIAL

It is a source of much satisfaction to all interested in the progress of orthopedic surgery to learn that a new French journal, devoted to the interests of this subject, will appear about the first of the new year (1914).

The Editorial Board of the Journal of the American Orthopedic Association has great pleasure in offering its readers and the members of the American Orthopedic Association, in this number, the first of a group of four articles to be sent us by our orthopedic colleagues in France. It is through his interest in promoting a more intimate acquaintance between those who are working in the same fields in France and here that Dr. Calvé has made possible the publication of these papers.

A similar and no less gratifying situation has developed in Italy, and Prof. Putti has promised us four articles from representative Italian orthopedists, to be ready for publication in 1913–14.

We already have the promise of some of the scientific work of two of our English confréres, all of which not only bespeaks the international activity of, and interest in, orthopedic surgery, but should serve to place us here in America on our metal to put forth our best effort that we may enlarge our scientific output and take advantage of the outlet for it which these closer international affiliations afford.

At the recent International Medical Congress in London it was plainly evident that orthopedic surgery had become a specialty of international importance. The sessions of the section were largely attended by from sixty to eighty men, and among these men were the majority of the prominent orthopedic surgeons in Europe. The sessions were marked by harmony and good fellowship, the discussions were friendly and illuminating, and the papers throughout were of the highest character. No orthopedic meeting has ever been furnished with papers of such importance read by a group of first-class men from ten different countries.

The great advance made by this section over a similar section in Budapest four years ago was very evident, and having brought about such an important international coöperation and community of interest it seemed undesirable that the future should be left unprovided for. A motion was consequently made asking for the appointment of a committee, consisting of one member from each nation actively represented at the Congress, to consider the advisability of the formation of an international orthopedic society. The motion provided that the chairman of the section, Mr. Robert Jones, should be a member of the committee.

This committee met, and after a careful discussion of the matter reported unanimously in favor of the formation of an International Orthopedic Association. There was no real opposition to the movement at any time by any group of men, but the committee was obliged to define more or less what would be the objects of such an association. They reported that there were three functions which might be fulfilled by such an association.

1. To see that orthopedic surgery was properly represented at important congresses by competent men, and that its interests should be furthered so far as possible by the members of the association.

2. To provide if possible for a better interchange of orthopedic literature, a movement already started by the *American Journal of Orthopedic Surgery*. It was hoped that in some way it might be possible to furnish more frequent translations of important foreign articles to members of each country.

3. It was thought desirable that occasional meetings should be held by the international society. It was felt, however, by all the members of the committee that there were at present too many medical meetings, and that frequent meetings would be

undesirable. It was also felt, in view of the great success of the orthopedic section of the recent International Congress, that the international society should not in any way interfere with the sectional work of the International Congress when this would be properly taken care of by the Congress, but in case the Congress met in some remote place or in some city where orthopedic surgery was neglected it might be necessary for the international society to hold a meeting at that time. No provision, however, was made for any immediate meeting.

The committee as appointed by the chairman consisted of: England, Robert Jones, Liverpool; France, Kirmisson, Paris; Germany, Vulpius, Heidelburg; Austria, Spitzy, Vienna; Hungary, Dollinger, Budapest; Italy, Putti, Bologna; Russia, Turner, St. Petersburg; Canada, Starr, Toronto; United States, Lovett, Boston; Holland, Jansen, Leiden.

The section on orthopedic surgery, after considering the committee's report, voted that the temporary committee should become a permanent committee, and should be requested to organize a society for orthopedic surgery, carrying out in general the aims as presented in the report. The committee so appointed subsequently met and organized, with Dr. Lovett as chairman and Dr. Spitzy as secretary.

Plans have naturally not yet been formulated for the organization of the society, but it is evident that it must be an elective society of a limited membership, which shall compare favorably with the other special international societies. Too large membership would make it compare unfavorably with such societies as the International Society for Surgery, the International Society for Genito-urinary Surgery, and similar bodies. With a proper and carefully considered organization it would seem as if the interests of orthopedic surgery might be very distinctly advanced by such an association. The public spirit of the committee concerned in the organization of the movement was evident, and the disposition of everyone present was to do what on consideration seemed best for the interests of orthopedic surgery. The organization of such a society must naturally proceed slowly, and the intention of the committee was that all matters of importance, such as the election of members and determination whether meetings should be held, etc., should be acted upon by the whole committee. The committee is sufficiently representative to promise well for the representation of the different countries concerned.

REPORTS OF SOCIETIES.

ORTHOPEDIC SECTION, INTERNATIONAL CONGRESS.

The Seventeenth International Congress of Medicine has come and gone, and the subsection of orthopedic surgery has attained a success which cannot be gainsaid. A feeling of good fellowship has prevaded all its meetings and the Celtic geniality of its president was as infective to its members as any of the microbic invasions to the diseases discussed. But the most important element in our discussions has been the high standard of scientific accuracy and logical reasoning that has been almost universally adopted. The days of empiricism in the treatment of deformity would surely be fast ebbing were it only possible to educate the world's deformed that a precise and accurate knowledge of the anatomy and pathology of deformed structures is necessary before a successful plan of treatment can be foreshadowed.

On rumination, after all the reports and papers have been read, one cannot but be struck, not only by the enormous strides that orthopedic surgery has made since the last Congress was held in London, but also by the irresistible possibilities for advance in the immediate future.

It would be impossible in the space at my disposal to do justice even to the reporters, far less to the writers of independent papers. Ten sessions were fully occupied and the interest was well maintained even to the end of the last session, when a committee, nominated by our president to carry on the work of an International Orthopedic Association, was formally confirmed and empowered to control the interests of that association until the next International Congress of Medicine at Munich in 1917.

But to revert to a few of the subjects in which recent advances have been made—the discussion on spastic paraplegia was opened by Mr. Muirhead Little and Prof. Vulpius: Prof. Spitzy gave us a résumé of the report of Prof. Küttner who was unavoidably absent. He alluded to Dr. Stoffel's neurectomy and described his own elaboration of neuroplasty. Prof. Foerster gave us a most interesting paper dealing with the physiology of the condition profusely illustrated by lantern slides. The diversity of methods advocated by these and subsequent speakers only proves how difficult is the treatment of such cases and how far we still have to travel before we reach a final solution.

The discussion on scoliosis was opened by Dr. Lovett.

His handling of this most difficult subject was a masterpiece.

His report contains a lucid and unbiased account of our present-day knowledge and it might well be taken as a model by future reporters at future International Congresses, of how a report should be presented. Prof. Schanz followed with a powerful advocacy of his well-known method of forcible correction and plaster jacket, while Dr. Abbott confined himself to an enunciation of the principles of his recently introduced method of forcible correction in flexion.

Somehow, I think, we should all have liked to hear more from Dr. Abbott himself of his technic and the results he had personally obtained. Dr. Calot showed lantern slides of cases treated by Abbott's method. The excellence would have been enhanced by confirmatory X-ray proof of the spinal column before and after treatment.

The discussion on the treatment of ankylosis was opened by Dr. Baer and Prof. Putti and proved one of the most interesting of the subsection. Dr. Baer advocated the pig's bladder membrane which is best known under his own name and showed us lantern slides demonstrating the physiology of the membrane after application in a remodeled joint and many excellent results in many parts of the body. Prof. Putti advocated the interposition of autogenous fascia lata.

His work has largely been performed on ankylosed joints following injury. Prof. Helferich, speaking in English, cleared the ground of many misconceptions and added his weighty authority to the subject.

The discussion on the treatment of tuberculous joints in children was shortly opened by Prof. Dollinger, Dr. Torrance Rugh reading the report of Dr. Ridlon who was unavoidably absent. A long and interesting discussion followed, during which Dr. Albee demonstrated the principles and technic of his bone transplantation for Pott's disease. Space only prevents my dilating upon the interesting features introduced by Prof. Vulpius, Dr. Ménard, Dr. Rollier (of sun cure repute) and Dr. Froelich.

The discussion of the value of radiography in orthopedic surgery, held in conjunction with the section of radiology, was introduced by Dr. Nové-Josserand and Dr. Redard, and their method of dealing with the subject showed that orthopedic surgeons have not been slow to employ the "flambeau" to the investigation of deformity. Perhaps in no other discussion was the progress of orthopedic surgery so well demonstrated and the future possibilities of our science so clearly outlined. And though these were the formal discussions, independent papers elicited new ideas and interchange of views on many others.

Congenital dislocation of the hip occupied our thoughts. Paralytic calcaneus was dealt with by Dr. Royal Whitman in a short and concise manner, and it is noteworthy that Prof. Lucas-Championnière's treatment of congenital club-foot, by ablation of all the tarsus except a small part of the os calcis, received its just condemnation.

The few moments between the sessional meetings were crowded with instruction and entertainment. At the Royal National Orthopedic Hospital Dr. Albee operated upon a child with Pott's disease demonstrating his method of fixation by means of a bone graft taken from the tibia; Dr. Royal Whitman operated upon two cases of paralytic calcaneus by removal of the astragalus, transplantation of the peronei and displacement of the foot backward, while Dr. Abbott demonstrated his method of applying a plaster jacket to a scoliotic spine after correction in the flexed position. I feel that in offering my thanks to them I am only penning the unanimous opinion of all members of the subsection.

Of the entertainments, the dinner at the Royal National Orthopedic Hospital at the commencement of the Congress afforded an opportunity of meeting old, and making new friends, while the dinner given by our president two nights later at the Royal Automobile Club proved to the ladies of the subsection the earnestful intentions of international surgery.

A special section of the museum was devoted to orthopedic subjects, in which there was a maximum of interesting specimens and records and a minimum of mere orthopedic apparatus. Special reference must be made to the kindness (among others) of Prof. Lovett, Dr. Abbott, Prof. Schanz, Prof. Foerster, Prof. Putti, Drs. Stiles and Fraser and to Dr. Stoffel (whose lucid models showing the operation of partial neurectomy, arrived rather late and suggestive of the surprise and disappointment of an inquisitive Douanier) for helping to make this department so interesting and instructive.

NOTICE.

The Committee on Fractures of the American Surgical Association desires to have two reprints of any paper dealing with the nonoperative or operative treatment of open or compound fractures which have been published within the last five years.

The Committee also desires papers on the medico-legal relations of radiography to the diagnosis and treatment of fractures.

If authors on these subjects have no reprints, the Committee would be pleased to receive memoranda of the places of publication of such papers.

JOHN B. ROBERTS,
Chairman, Committee on Fractures,
313 S. 17th St., Phila.

ABSTRACTS.

I. TUBERCULOUS LESIONS OF BONES, JOINTS AND TENDONS. GENERAL ARTICLES ON TUBERCULOSIS.

X-ray Treatment of Bone and Joint Tuberculosis. By Fr. Schede. *Zeit f. orth. Chir.*, 1913, Bd. XXXI, Heft 3–4.

Author arrives at the following conclusions: 1. it is best to give small doses without protection of the skin; 2. the best results were obtained in fistulous cases; 3. author has seen no damage done to the epiphysis; 4. X-ray treatment is always to be combined with general and orthopedic treatment; 5. X-ray treatment is contraindicated in cases of abscesses near the surface.—*Geo. I. Bauman, Cleveland, O.*

The Diagnosis of the Tubercular Character of Joint Disease. By E. G. Brackett. *Boston Med. and Surg. Journ.*, Vol. CLXVIII, No. 19, May 8, 1913.

An interesting and suggestive paper in which the author suggests that "formerly the diagnosis of the tubercular character of a joint disease was a comparatively simple matter, for there were not the fine distinctions to be made as to the character of an arthritis."

He makes a plea for the more careful *clinical* study of a case before using the X-rays and the laboratory aids in making a diagnosis, and tabulates certain points which may prove useful and which are in danger of neglect. There are: 1. the value of special clinical symptoms; 2. the routine methods of diagnosis; 3. diagnosis between articular or periarticular disease; 4. location of bone focus.—*James Warren Sever, Boston.*

The Diagnostic Significance of the Leukocyte Count in Osteomyelitis and Tuberculosis of the Bones in Childhood. By Eben W. Fiske, Boston. *Boston Med. and Surg. Journ.*, Vol. CLXVIII, No. 17, April 24, 1913.

The author in an interesting paper compares the leukocyte counts in a series of cases of both types—in relation to the general condition of the child—and before and after operation. He states that the routine examination of children with tuberculosis of the bones and osteomyelitis, two-thirds of the cases in both diseases being in an acute stage, shows an average white count of 11,600 for the former and 16,200 for the latter, a significant difference of about 5000 leukocytes. That their difference is constant and is a reliable factor in diagnosis is shown by the fact that in osteomyelitis but 20 per cent. of the counts were below 12,000 as compared with 66 per cent. in tuberculosis, while 39 per cent. of the former were over 18,000 about 13 per cent. of the latter over 15,000. This difference is still more emphasized in the acute cases, which make up the majority seen in hospital practice, the average for osteomyelitis being 22,200 and for tuberculosis 11,400, a difference of nearly 11,000. He states that the results of this study are therefore largely a confirmation of the well-known theory that leukocytosis does not occur in bone infection by the tubercle bacillus, but only in the presence of a pyogenic organism.—*James Warren Sever, Boston.*

Tuberculous Osteomyelitis of the Digits. By Robert M. Green. *Boston Med. and Surg. Journ.*, Vol. CLXVIII, No. 22, May 29, 1913.

Green presents an interesting paper well illustrated. He states that tuberculous osteomyelitis of the digits is essentially a disease of infancy and childhood, which tends strongly to spontaneous recovery. Pathologically it is characterized by bone destruction and rarefaction, and by chronic inflammatory reaction in the surrounding soft tissues. It may heal by resolution and absorption, or by sequestration, suppuration and sinus formation. The prognosis is good for anatomic and functional recovery, and is proportionate to the amount of bone destruction and scar formation.

In treatment the emphasis is to be laid on general hygiene and local fixation. Incision should rarely be resorted to, and amputation is almost never indicated.—*James Warren Sever, Boston.*

II. PARALYTIC DISEASES AND THEIR DEFORMITIES. NERVE LESIONS WITH ARTHROPATHIES.

Prognosis in Infantile Paralysis. By Wisner R. Townsend. *New York State Journal of Medicine*, May, 1913, Vol. XIII, No. 5.

The author says that the prognosis of infantile paralysis must be considered from various standpoints. First, as to life and death; second, as to the chances of complete recovery. If not complete, to what extent will the patient recover, and, knowing the extent of the paralysis, what will be the effect on development and what deformities will develop; fourth, what will be the result or neglect of treatment?

The author gives tables showing the mortality in various places, and goes fully into the prognosis during the various stages of the disease with resulting deformities if untreated.

He reaches the following conclusions.

"In looking over all these questions relating to prognosis it must be understood that while they all have a bearing and are of great value when one comes to study the individual case, one may be much perplexed as to the proper prognosis to make. When a patient is first attacked prognosis must be guarded. If it is of the pontine or bulbar type, or in an epidemic, with a high mortality, or in the very young or the very old, prognosis is not as good as in other cases. The mortality may be put down as from 5 to 25 per cent. About 25 per cent. of the total affected may be of the abortive type. By the end of the second week electrical examinations may enable one to make a rather positive prognosis as to which muscles will be affected, but no definite conclusion can be reached as to how far they will be affected and what the ultimate results will be before the end of six months. Definite conclusions can be given by the end of a year as to what the ultimate results will be. Deformities both primary and secondary can be predicted and thus prevented. Proper orthopedic treatment will give the best results."—*Archer O'Reilly, St. Louis, Mo.*

Hysterical Contractures after Injury. By A. Hartung. *Arch. f. Orthop., Mech. u. Unfallchir.*, Bd. XII, H. 1 and 2.

Upon special inquiry these patients will be found to have been under severe mental strain, etc., at the time of the injury. The purpose of the contracture seems to be to protect the limb from motion, and usually the hysterical deformity will be found to take the shape assumed by the limb, in the protective dressings which previous physicians have employed.

The prognosis is never good. Function should be restored in all the neighboring joints. The joint or limb even if operated must never be fixed in the position in which the hysterical contracture tends to hold it.—*Walter G. Stern, Cleveland, O.*

III. METABOLIC DISTURBANCES CAUSING BONE AND JOINT DISEASES. INFECTIOUS ARTHRITIS, OSTEOMYELITIS, ETC.

Some Form of Chronic Rheumatism, known as Fibrosites. By Mr. V. Venkata Rao. *The Hospital Assistant*, Kolhapur City, Bombay Presidency, India, April 31, 1913, Vol. VIII, No. 4.

Fibrosites are mainly an inflammatory hyperplasia of the white fibrous tissue in various parts of the body, hence the name. They are more common in the second half of life. The fibrous tissue of the joints, muscles and bones, especially the aponeurosis, and insertions of the muscles, fascia and fibrous ligaments of the joints and periosteum are primarily involved. The synovial membrane, cartilages and bone may be secondarily involved. These cause pain and stiffness and appear in patches. They may result from exposure, injury or toxins. The localized induration may be felt.

On the whole the author describes a condition which is very similar to those diseases which we class as hypertrophic and infectious arthritis. The treatment is also similar to the treatment in these conditions.—*Archer O'Reilly, St. Louis, Mo.*

Localized Osteomyelitis of the Long Bones. By Claming C. Simmons. *Boston Med. and Surg. Journ.*, Vol. CLXVIII, No. 18, May 1, 1913, p. 637.

A report of twenty-six cases of what are practically cases of "Brodie's Abscess." The author believes that mild acute early cases are often overlooked. In every case the abscess should be opened and in the old chronic cases he believes that better healing is obtained if a muscle or skin flap is transplanted to fill the cleaned-out abscess cavity, for he states the bone is not capable of regenerating sufficiently to do so of itself.—*James Warren Sever, Boston.*

Osteomyelitis with Bone Transplantation. By Frank A. Hamilton, M. D. *Journal A. M. A.*, June 28, 1913.

A case is reported of osteomyelitis of the tibia in which the author after taking out the diseased bone at a third operation, transplanted a piece of the fibula about 3 inches long between the cut ends of the tibia. The result was excellent.—*Edward S. Hatch, New Orleans.*

IV. BONE AND JOINT TUMOR, BENIGN AND MALIGNANT.

Tumors of Bone. By Samuel Beresford Childs. *Colorado Medicine*, May, 1913, Vol. X, No. 5.

The author reviews rather briefly the X-ray picture in various bone tumors. These include spurs on the os calcis and elsewhere exostoses of the spine. Osteoarthritis, osteitis and periosteitis, bone abscess, tuberculous and nontuberculous, bone cysts, and sarcoma.

The paper is intended for the general practitioner and emphasizes the necessity of having X-ray pictures in all cases of bone disease and these as early as possible.—*J. A. O'Reilly, St. Louis, Mo.*

V. SCOLIOSIS AND STATIC DISTURBANCES.

Fetal Disturbance of Development of the Pelvis and of the Spine as a Cause of Deformities, Especially of Scoliosis and Congenital Dislocation of the Hip. By Edmund Falk. *Zeit. für orth. Chir.*, 1913, Bd. XXXI, Heft 3–4.

A description of a number of spines and pelves showing anomalies of development which led or would no doubt have led to various deformities. This corroborates Böhm's contention that many cases of lateral curvature are due to anomalies in the spine. Similarly anomalies in the structure of the acetabulum lead to dislocation of the hip.—*Geo. I. Bauman, Cleveland, O.*

Contribution to the Subject of Flat-foot. By F. Cramer. *Arch. f. Orthop., Mech. u. Unfallchir*, Bd. XII, H. 12.

An X-ray study of 118 cases many of whom showed a chronic deforming arthritis of the bones of the tarsus. The chief deformity seems to have been in the neck of the astragalus.

In severe cases Cramer recommends a modified Ogston operation.—*Walter G. Stern, Cleveland, O.*

Intestinal Ptosis Producing Intestinal Stasis from the Orthopedic Viewpoint. By Robert Carothers. *Lancet-Clinic*, June, 1913, Vol. CIX, No. 24.

A number of cases of ptosis suffer from a congenital weakness, which makes them unfit to cope with present-day life. Together with the ptosis, constipation, etc., one finds other joint defects, flat-feet, and faulty posture.

The orthopedist can help these by correcting the flat-foot and posture, by putting the patient to bed for a few days and by stimulating the bowels by a laxative and a high enema and by then following this treatment with massage, scientific exercise, good food, and proper support. Intestinal stasis should be treated surgically, if persistent.

The author's conclusions are:

"1. An intestinal ptosis producing stasis is an acquired deformity inside the abdominal cavity associated with other deformities there and also on the outside of the body.

2. That a certain percentage of these cases are benefited by palliative treatment combined with a vigorous correction of the external deformities —sometimes cured.

3. Like the rigid flat-foot, a certain percentage are only to be relieved by operative interference after palliative measures fail."—*Archer O'Reilly, St. Louis, Mo.*

VI. CONGENITAL DEFECTS, INCLUDING CONGENITAL DISLOCATIONS.

Report of a Case of Total Congenital Absence of the Femur (Phocomelic). By J. J. Thomas. *The Cleveland Medical Journal*, May, 1913, Vol. XII, No. 5.

The author reports a case of complete absence of the right femur. The X-ray is given.

The condition occurred in a congenital syphilitic child in which a positive Wassermann was obtained from both the mother and the child.

Only about twelve other cases have been reported with this condition.—*Archer O'Reilly, St. Louis, Mo.*

The Relation of Heredity to Congenital Dislocation of the Hip. By K. Hayashi and M. Matsuoka. *Zeit. f. orth. Chir.*, 1913, Bd. XXXI, Heft 3–4.

In 230 cases of congenital dislocation of the hip authors found nineteen cases with a hereditary influence. They divided these cases into five types as follows: 1. Collateral heredity. Father and mother healthy. An aunt or uncle has a dislocation—five cases. 2. Crossed heredity. Father and daughter or mother and son have dislocations—one case. 3. Father and son or mother and daughter have dislocations— one case. 4. Indirect heredity. Consanguinity of otherwise healthy parents—seven cases. 5. Occurrence of several cases in same family—five cases.

Heredity influence in congenital dislocation of the hip shows itself more frequently on the father's than on the mother's side.—*Geo. I. Bauman, Cleveland, O.*

Congenital Deformities Combined with Congenital Dislocation of the Hip. By K. Hayashi and M. Matsuoka. *Zeit. f. orth. Chir.*, 1913, Bd. XXXI, Heft 3–4.

In 230 cases of congenital dislocation of the hip authors found twenty-five cases combined with other deformities. The most common deformity was a congenital contracture and next to this deformities of the feet. Authors found 140 cases reported in the literature and in these the most common deformities arranged according to frequency were club-foot, genu-recurvatum, spina bifida and torticollis.—*Geo. I. Bauman, Cleveland, Ohio.*

Congenital Elevation of the Scapula (Sprengel's Deformity). Hereditary Type. By Harold Neuhot. *Zeit. für. orth. Chir.*, 1913, Bd. XXXI, Heft 3–4.

From an investigation of the ancestry of seven cases of Sprengel's deformity author concludes that 1. congenital elevation of the shoulder appears as a hereditary form; 2. deformities of the scapula and defects in the trapezius (as well as other similar anomalies) are part and parcel of a general disturbance of development; that is. 3. Sprengel's deformity is an evidence of a reversion to a lower type, at least in the hereditary cases. In other single cases it is most probably an evidence of such reversion. 4. On careful investigation one would probably find that many cases of congenital elevation of the shoulder are of the hereditary type. Valuable information as to the cause of this deformity would no doubt be obtained in this way.—*Geo. I. Bauman, Cleveland, O.*

Malformations of the Upper and Lower Extremity Resulting from Arrested Development. By E. Loewenstein. *Zeit. f. orth. Chir.*, 1913, Bd. XXXI, Heft 3–4.

Author reports a rare case of arrest of development of endogenous origin. The deformity consisted of bony ankylosis of ring and middle fingers, short index and little fingers, deviation of fingers and toes, web-fingers, Madelung's deformity (probably also congenital), and asymmetry of skull.—*Geo. I Bauman, Cleveland, Ohio.*

VII. TRAUMATIC LESIONS, FRACTURES AND DISLOCATIONS.

The Central Dislocation of the Femur. By Z. Brind. *Arch. f. Orthop., Mech. u. Mech.*, Bd, XII, H. 122.

The author gives a short résumé of the forty-four cases to be found in the literature and adds a forty-fifth which occurred in the service of Dr. Taendler in Berlin. The leading symptoms of this condition are 1. the rotation (sometimes inward, often outward) of the entire limb; 2. shortening; 3. position of the trochanter anterior to Nélaton's line; 4. flattening of the buttocks; 5. pain on motion; 6. the ease of replacing the limb into the normal position and the reappearance of the deformity as soon as the corrective force ceases.—*Walter G. Stern, Cleveland, O.*

The Treatment of Fracture of the Patella, a New Method of Reconstructing the Extention Apparatus. By Ferdinand Schultze. *Zeit. für. orth. Chir.*, 1913, Bd. XXXI, Heft 3-4.

Author arrives at the following conclusions: 1. Separation of the patellar fragment indicates a tearing of the quadriceps on a level with the fracture. Separation of the fragments without tearing of the muscle is impossible. 2. For union of the fragments stitching of the torn muscle is necessary. 3. The best method of treatment is to unite the torn muscle and ligaments. 4. A special clamp is used to bring the fragments and the torn structures together. It is possible with this clamp to overcome the muscle-pull and to fully unite all the torn structures. 5. Stitches are removed on the tenth day and exercises are begun about the twelfth day. The early beginning of exercises is the best guarantee of an early return to normal function.—*Geo. I. Bauman, Cleveland, Ohio.*

Restoration of Function after Traumatic Disability. By Gustav Scheutz. *Arch. f. Orthop., Mech. u. Unfallchir.* Bd. XII, H. 122.

It is apparent at present that in the early years of the enforcement of the German workingmen's compensation laws, the account of damages or rather proportional disability was judged entirely too high. In many cases the injured party took advantage of the facility with which anatomic abnormalities or exaggerations of subjective symptoms were translated into terms of permanent disability. Scores of cases, examined in later years, revealed the startling fact that patients previously declared totally disabled had been able to accommodate themselves to their disabilities and to resume their previous occupations, etc.

In cases where the injury of previous years did not result in claims for damages, one can get an even better idea of how a serious disability may be entirely overcome. Most cases of injury which do not lead to claims for indemnity, when compared to the same sort of an injury for which such claims are made, make rapid and complete recoveries.

The author cites many cases which came to Prof. Hoftman's Clinic in Königsberg for various reason, not connected with the injury or disability under discussion, giving histories of the early resumption of work after severe accidents, for which no claim had been made. The patients soon resumed their occupations as though nothing had happened.

Case 1. Fracture of neck of humerus. Patient cannot raise arm much above a right angle. Makes full wages as a common laborer, has no disability as far as arm and shoulder are concerned. Had this case come under the compensation laws, the man would have at least received a permanent pension on the basis of 35 per cent. reduction of his earning capacity.

Case 2. Osteomyelitis of hip and elbow with ankylosis and deformity of both joints nineteen years before, had been able to do the heaviest work on the farm fifteen years past.

Cases 3, 4, 6, and 8 are cases of the severest grade of deformity of the hip-joint after fractures following which the patients resumed the hardest kind of manual labor.

Cases 9 and 10 suffered from Pott's fracture with severe deformity, which, however, did not hinder them in being fully self-supporting. (The reviewer has long noted the same conditions existing in Ohio, together with the fact that the injured person has never needed to seek very far to find a physician willing to pronounce him incurable, or totally disabled on the grounds of the usual results from ordinary injuries, exaggerated symptoms, neurasthenia, fear, etc.—*Walter G. Stern, Cleveland, Ohio.*

Fracture of the Long Bones. By S. D. Vanmeter. *The Therapeutic Gazette*, May 15, 1913, Vol. XXXVII Whole Series, Third series Vol. XXIX, No. 5.

The author believes that it is often very difficult to get proper reduction by manifestation, and if reduction is secured it is often difficult to maintain by splints. In these cases some operative procedure is demanded. This may consist in the use of the Parkhill clamp and its modifications, such as apparatus intended to be removed after the union is secured or by the Lane plate to be left in.

Absolute asepsis is demanded in either method. Infection is much more apt to occur, however, in the former method where screws, etc., pass through the skin and soft parts to the bone.

The Lane plate, on the other hand, is equally as efficient as a splint is easily applied and when once in place the wound is entirely closed.

The author reports seventeen cases with X-ray pictures showing the results obtained by the use of the Lane plates. He reaches the following conclusions:

"1. The open treatment of fractures insures practically anatomic reduction.

"2. We have overestimated the danger of making a compound out of a simple fracture.

"3. The Lane plate is the simplest and most efficient fixation device yet designed.

"4. It insures immediate immobilization, which in turn means rapid repair and reduction of pain to a minimum.

"5. Its application is easier and requires less mutilation and smaller incision than the use of wire.

"6. It is a great aid in the management of compound infected fractures.

"7. Direct mechanical fixation of fractures greatly simplifies after-treatment.

"8. The X-ray has shaken our confidence in manual reduction, and will force us to more accurate methods."—*Archer O'Reilly, St. Louis, Mo.*

Floating Cartilage in the Knee-joint. By Clark D. Brooks, M. D. *Jour. of the Mich. State Med. Soc.*, June, 1913, pp. 307–309.

The author says these may have their origin either from one of the semilunar cartilages becoming displaced or the so-called loose cartilages may occur in cases of osteoarthritis in which calcareous or cartilaginous material is formed in one of the synovial fringes and constitutes the foreign body and may or may not become detached. He reviews the symptoms and diagnosis, insisting that locking is always present. All loose cartilages or bodies should be removed as soon as the diagnosis is made. In the technic he emphasizes the necessity of avoiding trauma and of perfect asepsis. Brooks reports five cases; detailed report not given, but says their histories were typical. All patients made perfect recoveries.—*M. S. Henderson* (*M. B., Tor.*), *Mayo Clinic, Rochester, Minnesota.*

IX. MISCELLANEOUS DISEASES. GENERAL ORTHOPEDIC ARTICLES. PHYSICAL THERAPY.

A Twelve-year Experience in Orthopedic Surgery. By Wm. Becker. *Arch. f. Orthop., Mech., u. Unfallchir,* Bd. XII, H. 122.

Becker's report is enhanced in value to many, by the fact that his patients have all been treated by him at his office as private patients and that with few exceptions they were only given hospital care and treatment for a few days, after operative procedures. The goal of all orthopedic measures is the restoration of the weight-bearing functions of the bones, the motion of the joints and the strength of the muscles.

Becker holds the most important to be the strengthening of the muscle power to enable the body to properly control its restored bones or joints. He describes the attempts of the operative surgeon to dabble in orthopedics as well as the attempts of the mechanic (Hessing for instance) as useless or even harmful in the long run. The basis of the orthopedic treatment will never be purely operative procedures. Becker recommends his electric "myomotor" for exercising muscles, as well as his hot-air Zander apparatus for mobilizing stiffened joints. Both seem to be better fitted for their purpose than the simpler apparatus now in common use. In some cases a course of baths are indicated. He recommends the use of celluloid for braces, splints, etc., and in general follows the German orthopedic surgeons in the use of Hessing's patterns.

In spondilitis tuberculosa he recommends the use of the Lorenz plaster bed until the deformity has been corrected, followed by the usual plaster jackets put on in hyperextention. This is followed by a course of treatment calculated to strengthen the muscles. Abscesses or threatened paralysis are combatted by the dorsal position and the plaster bed. He warns against the subcutaneous tenotomy of the sternomastoid in my neck on account of the danger of cutting the bulbus jugularis. The operation at the mastoid has not yielded him as good results as the usual open tenotomy, followed by fixation in a Schanz cotton bandage and the proper orthopedic treatment to guard against recurrences.

Coxa valga in childhood is characterized by the failure of intimate contact between the joint surfaces of the femur and acetabulum; a sort of subluxation as it were, and is to be treated by forced abduction and flexion even in the adult cases. Coxa vara is a consequence of weight bearing in excess of the strength of the neck of the femur, of chronic repeated traumæ or of fracture. Tenotomy of the adductors, fixation, extension and rest constitute the treatment.

In the treatment of tuberculous coxitis, Becker follows Lorenz so closely that an abstract of this chapter is unnecessary. He quotes many cases treated by fixation or fixation extension, which would have been resected by the general surgeon.

Chronic ischias is to be treated by hot-air baths, massage and motion in the Zander apparatus: in acute cases injecting the nerve may be tried. It is sometimes successful.

In tuberculous disease of the knee there are only two useful results: 1. a freely movable knee-joint; 2. a firmly ankylosed joint in good position. All else is evil and will lead to future complications.

In congenital club-foot after the usual redressment and correction it is best to keep up the strength of the peronei muscles to prevent recurrences. It is important to wear a brace at night, so as to keep the weight of the bed clothes off of the feet.

Progressive muscular atrophy must be combatted through a very long series of years by massage, passive motion, correction of deformities, etc.—*Walter G. Stern, Cleveland, O.*

Arthroplasty. By John B. Murphy, Chicago. *Annals of Surgery*, Vol. LVII, No. 5, May, 1913.

This paper is of the utmost interest and value, but is of such a character that it cannot be abstracted. It represents the author's experiences in arthroplasty of the various joints-, such as the hip-, shoulder, elbow-, knee-, and wrist-, in which he has used his well-known method of using a muscle, fat and fascia flap. The results are most striking and encouraging.—*James Warren Sever, Boston.*

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XXVII.

THE TREATMENT OF TUBERCULAR COXITIS.

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The articles by Packard, Taylor and Bradford, and the discussion of Taylor's article by Lovett, Ely, Wilson Gibney, Albee and Mackenzie, published in the *American Journal of Orthopedic Surgery* for February, 1913, prove that the treatment of tubercular hip-joint disease beyond the Atlantic is still in an unsettled state.

The Lorenz clinic is very much interested in this question: Primarily, because she has during the past decades observed a vast amount of material relative hereto, and secondly, because Lorenz it was, who has grounded and worked out the weight-bearing therapy of tubercular coxitis in place of the conventional traction therapy.

This latter circumstance, however, has not been given due credit by our American friends in the above-mentioned articles and discussion. With the exception of the acknowledging words of Gibney, I fail to note that literary historical justice, which is fundamental to the promotion of scientific discussion.*

It is for this reason that I wish to particularly emphasize the credit due Prof. Lorenz for his work in this subject.

Traction or weight bearing, that is the question!

For us, however, it is no more a question, and this for the specific reason that we look upon ankylosis as the most desirable end-result of the mechanical treatment of coxitis. On the decision, ankylosis or movable joint, stands or falls the question of the weight-bearing treatment.

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* Polemical discussions as to priority have but little part in the discussion of papers on this side the Atlantic. I am sure we should all be willing to concede to Dr. Lorenz and his confrères the credit of giving the proper emphasis to fixation methods in the treatment of hip disease. That we don't debate these points indicates that we attach less importance to them than do our German colleagues. [Eds.]

We therefore espouse the cause of an ankylosing therapy and we are convinced of our inability to win over to the weight-bearing therapy those who seek the welfare of coxitis therapy in a possibly movable joint. For this reason I consider it very necessary to accentuate the importance of ankylosing the hip-joint.

It has not been very long since we ourselves believed in obtaining a movable hip-joint by the mechanical treatment of coxitis. I myself remember—it is now perhaps nine or ten years ago—that, led by the idea of securing a possibly movable joint, we nearly daily corrected the old, healed and contracted coxitides by the intraarticular redressement. Only through the results have we learned that the salvation of the hip disease afflicted individual is to be sought in just the opposite—in ankylosing the joint.

Not least, however, were we led to this new path by the failures of intraarticular redressement.

We observed primarily local and general signs of reaction following the operation trauma. These hip-joints, intraarticularly corrected, were, for many weeks after operation, painful and very often showed local inflammatory phenomena; in many cases there occurred for weeks a rise of temperature and not seldom also abscess formation.

It left no doubt, therefore, that these seemingly healed joints, damaged by the trauma of the intraarticular redressement, were again made sensitive. Recurrence of tubercular hip-joint disease with all its painful and tedious suffering we observed often. All these experiences necessarily led to the conclusion of obviating the operative trauma, thus originating the extraarticular methods of correction, which we have since used in all cases of joint contractures, following healed tuberculosis.

Since it was an established fact with us, that even a seemingly healed joint, after traumatisation of its components, would nearly always react with local inflammatory phenomena, often with actual recurrence, we were compelled to leave the intraarticular redressement and choose an extraarticular method of correction, which, while leaving untouched the previously diseased area, would correct compensatorily in sound tissue. We were therefore forced to subtrochanteric osteotomy.

A second circumstance, however, even more plainly led us on this path. We saw in *nearly all* cases of contractures in adduction, which we corrected by intraarticular redressement after healing of the tubercular process, the regular recurrence of the adduction contracture—and who of our American friends has not seen adduction recurrences after intraarticular correction of the coxitic contracture?

We must all see these recurrences and especially must all those colleagues give evidence of this fact, who aim at securing a movable hip-joint.

It is an impossible fight, which we carry on against this adduction contracture, and the patient has only to use his limb when, sooner or later, an adduction contracture will show itself in the diseased joint. This adduction recurrence is a mechanical postulate and follows the inalterable laws of mechanics.

I will explain this circumstance more in detail. Normally, the action of the pelvitrochanteric muscles—glutæus maximus, medius and minimus—is to fix the trunk against the thigh in the act of walking and standing. In other words, when standing on one leg or in the first phase of walking, the pelvitrochanteric muscles fix the axis of the standing leg. The angle between pelvic axis and femur is 90°. A functionally fit hip-joint must therefore show the position as pictured in Fig. 1.

On the other hand, changes, as detailed in Fig. 2, must be evident in every hip-joint which has become insufficient. The angle between pelvic axis and femur is lessened, the accompanying movement is adduction, because it makes no difference whether the thigh is moved against the fixed pelvis or *vice versa*—the pelvis against the fixed thigh. The result is always a lessening of the pelvifemur angle, that is, an adduction movement in the hip-joint of the standing leg.

This adduction occurs in every phase of walking in which the diseased limb is used. It can easily be shown that complete paralysis of the pelvitrochanteric muscles is associated *absolute* insufficiency of the hip-joint. The patient cannot, without support or apparatus, walk with nor step on the diseased limb.

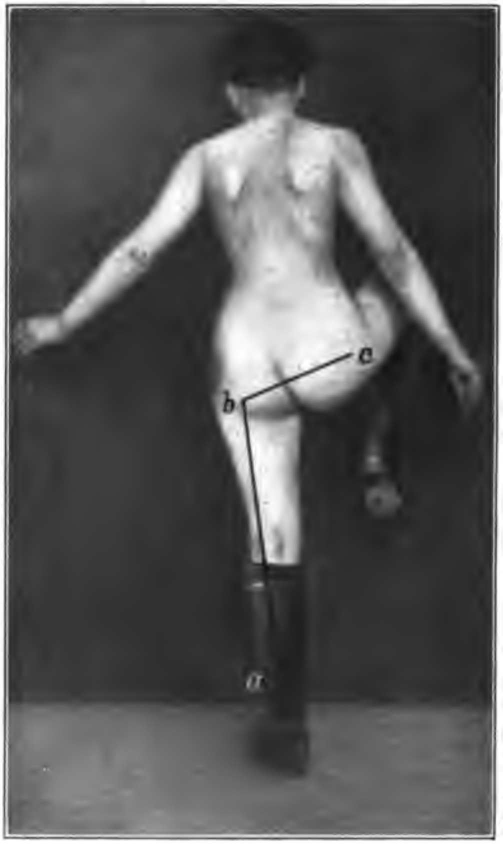

Fig. 1.—Functional test of the normal hip-joint. Pelvic axis—femur angle *abc* over 90°.

Paralysis or paresis of the pelvitrochanteric muscles is therefore the most striking example of insufficiency of the hip-joint.

A tubercular hip-joint becomes insufficient for several reasons. First and most important, an *absolute insufficiency* of the pelvitrochanteric muscles is present, because of the very high grade of demonstrable atrophy of these muscles. This is for the most part an arthrogenous, degenerative muscle atrophy, arising from a local damaging influence of the tubercular virus. To a lesser degree the atrophy is one of inactivity. The condition of the pelvitrochanteric muscles in coxitis may therefore be compared to a hip-joint with paresis of the pelvitrochanteric muscles.

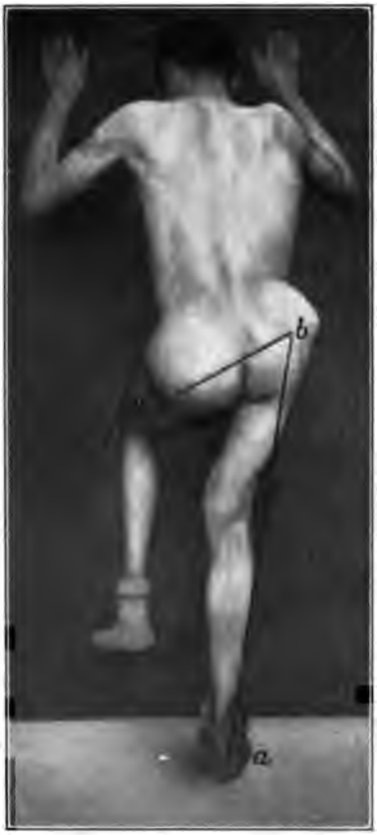

FIG. 2.—Insufficiency of the right hip-joint. Elevation of the greater trochanter. Pelvic axis—femur angle *abc* under 90°.

Aside from this *absolute* insufficiency, there is also a *relative* insufficiency of the pelvitrochanteric muscles in the coxitic patient. The greater trochanter rises toward the crista ilei during intraarticular destruction, clinically therefore upward over the Roser-Nelaton line and with this narrowing of their points of origin and insertion, the pelvitrochanteric muscles become too long and are unable to maintain equilibrium against the weight of the trunk. The pelvis therefore falls to the unsupported side, and an adduction is produced on the diseased side at every step by the whole body-weight.

The correctness of this explanation is easily seen in those cases in which there exists a plainly demonstrable high position of the greater trochanter, with a very evident relative lengthening of the pelvitrochanteric muscles.

I have, however, been able to show that very small intraarticular destructions offer mechanical conditions similar to those mentioned above, and that even the very smallest intraarticular displacements are therefore always accompanied by adduction. Hence the proposition that the position of adduction is the clinical expression of an intraarticular destruction. I have drawn attention to the fact that beginning destruction of the cartilage of the head or of the acetabulum, which can only be demonstrated in the X-ray picture and which clinically does not lead to a rise of the greater trochanter (Fig. 3) must clinically show an adducted position of the joint.

In a series of X-ray pictures obtained from the same joint, the following was established.

The joint stood in abduction flexion and outward rotation, the X-ray picture showed a normal joint aperture, and except for regionary atrophy of joint components, no changes, therefore no intraarticular destruction. After six weeks, during a reexamination, a beginning adduction position of the joint was observed. The spina anterior on the diseased side stood 1/2 cm. higher, the trochanter not above Roser-Nelaton's line, the X-ray picture, however, showed cartilage consumption, with intraacetabular displacement (Fig. 3).

There is no doubt, therefore, that in every hip-joint damaged by tuberculosis, adduction is produced at every step by the whole body-weight. The looser the connection between pelvis and proximal end of femur—in other words, the more movable the joint—the greater is the tendency to adduction. One speaks of procuring mobility and imagines thereby to be able to so obtain a condition of *restitutio ad integrum.* Granted, providing it were possible to *so* cure the tubercular process, that the joint would retain its normal anatomical form. Under hundreds, perhaps a few thousand coxitides, I have seen the one or other case heal without joint changes and with normal function. And against these few cases of healing with restitutio ad integrum, can always be raised the objection whether tuberculosis was actually the disease in question and not perhaps some other form of coxarthritis. In this connection it is well to consider the condition of such a joint, healed with mobility. The capsule is destroyed, the one capsular ligament is shortened and the other lengthened, the acetabulum widened and eroded by bony ridges; the head, if at all present, is deformed, displaced in the acetabulum, and often dislocated. The muscles dis-

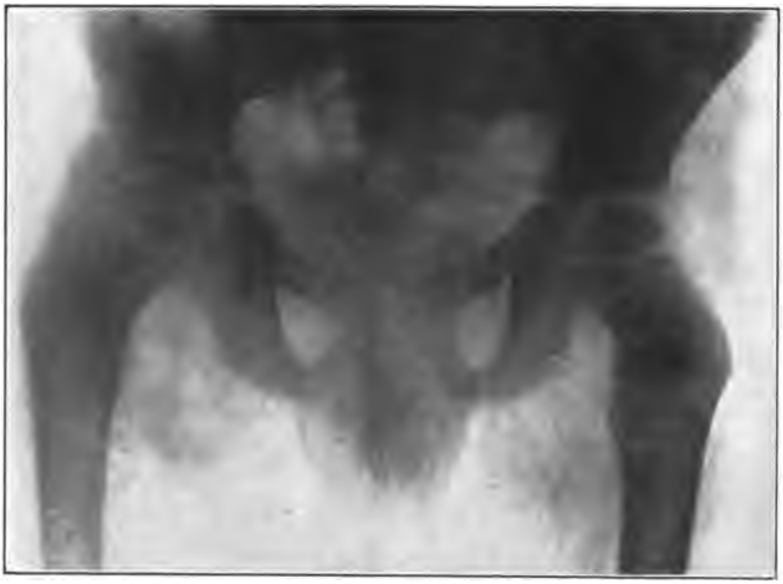

FIG. 3.—Left hip-joint shows intraacetabular displacement of the head. Disappearance of joint aperture.

placed around the joint, some lengthened and others again shortened and contracted. What hope is there for good function under these conditions? The continual movements in such a joint must cause the greatest suffering to the patient, the joint must, as its position to the direction of weight is abnormal, become sensitive. The joint must, earlier or later, become useless and functionally unfit. It must not be objected that not all coxitides heal with those changes which I have pointed in such somber hues. Even the slightest changes in the cartilage of the head and acetabulum cause those incongruencies which, according to Preiser, lead to a deforming arthritis. And tubercular coxitis, though it may heal with only minimal changes, is almost always mechanically predisposed to an adduction contracture.

In this way we came to the conclusion that the end-result of coxitis therapy should be an ankylosed and not a movable joint. This thesis, when first advanced, provoked general doubt and opposition, but as time went on a small number of advocates came to its support, and we have not given up the hope that we will be able to win others to our conviction.

Remarkable indeed it is that the correct way was suggested to us by the observance of just those coxitis patients who had never been treated and who years after recovery from their hip disease came to us for correction of their deformity. In our remote high and lonely Alpine regions, where for miles no physician's help is to be found, there we observed too often that the coxitic child ran about without any treatment whatever. When the time of military service or of marriage comes, then these patients cannot forego medical help. Their joints are no more painful, but they ask for correction of their deformity. Consider how much better is the condition of these untreated patients, notwithstanding their contractures, than the condition of those carefully treated, in whom extension was so faithfully employed to preserve motion in the joint! Our mountain children run and jump on their healed limb, they climb their high mountains without fatigue. Their limb is strong and only little atrophic, and ankylosed in the hip-joint, not sensitive, and functionally fit. The position of the leg is, no doubt, mostly very bad and severe flexion and adduction contracture are the rule.

Contrasted with this, the joint, treated by protection from weight-bearing and with extension, is for years sensitive and is even for years, after complete healing, functionally unfit, very easily tired, very atrophic, but, as we confess, in a relatively better position. Flexion is seldom found fully developed and adduction is limited to a lesser degree as long as the extending and weight abolishing apparatus is worn. But when the patient discards these, and sooner or later this always occurs, the adduction rapidly increases, and the long train of suffering with the pressure pains, fatigue and ugly deformity begin anew.

No, we do not want a movable joint! We attempt to secure ankylosis and in the very start of the care of the case we plan so, that relief of pain and the best possible condition for improvement in the local disease process go hand in hand with the obtainment of an ankylotic hip-joint.

From this it is very plain that we take a decided stand against continuous extension. Extension distracts the joint surfaces from each other, thereby offering the best condition for prevention of ankylosis. The pain-relieving components of extension we reach in a more comfortable manner, through simple fixation in a cast. There remains, therefore, now only to consider our position on the influence, exerted by extension, in removing or preventing threatening contractures. Lorenz has advanced the principle that, taken all in all, the contracted position of the coxitic joint should not, during the acute or subacute stages of the disease, claim our attention because, as mentioned above, a local bone or joint tuberculosis is harmfully influenced by every accidental or operative trauma. Every correction of the deformity therefore must be avoided which will in any way traumatize the joint in the least, until complete healing of the pathological process has taken place.

A forcible correction is therefore excluded at the start, and a gradual correction, which is perhaps possible during the course of many months by extension in bed, we discard, because the prolonged bed rest and disuse of the limb lead to severe disturbances of the bones and muscles, and thereby to uselessness. We prefer a functionally fit strong limb in less good position to one useless, atrophic and sensitive in good position.

We do not wish it to be understood, however, that we under no condition correct the deformity during the acute or subacute stages of the disease. In very early beginning cases which, after careful observation, have shown no spastic contracture of the hip-joint within fourteen days, we do not hesitate to apply the cast in narcosis, if a contracture is then present. I purposely say, to apply the cast in narcosis! because in such a case there can be no thought of correcting a contracture, the muscles relax in narcosis and the correction occurs spontaneously. A second indication for applying the dressing in narcosis we find in those subacute cases with such high-grade flexions or adduction contracture that applying the dressing in the pathognomonic position would preclude the patients walking. This refers mostly to cases which have had for some time a deformity, but in which the deformity has rapidly increased in a few weeks. In these cases by applying the dressings in narcosis we can get these patients on their feet. The purely muscular contractures, namely those which arose in the last weeks, correct themselves spontaneously and the dressings can be applied in a less pronounced deformed position without the use of any force.

We will allow that in these two indications, instead of narcosis a preparatory extension treatment of from eight to ten days might be chosen after which the dressing could be applied.

We discountenance, however, for reasons given above, any attempt to correct by extension contractures existing over a period of more weeks or months. In such cases it is not sufficient to remove the spastic condition of the muscles, but one would have to overcome the long standing, nutritive shrivelling of the soft parts, and this is only possible by prolonged bed extension or the wearing of a correcting suspension apparatus over a period of many months.

The *indicatio morbi*, as well as *indicatio orthopedica* would, with the exception of the two previously mentioned indications, allow dispensing with extension and permit the choice of a simple dressing for the relief of pain. The only function demanded of this dressing is solely that of fixation. This demand has also its reason. It is based on the knowledge that there are two kinds of joint pain (Lorenz)—(1) Pain during movement of the joint surfaces against each other, and (2) pain during weighting the joint. The pains of the first variety have their cause in changes of the soft parts of the joint, with normal relation of the joint bodies to each other, while the weight-bearing pains have their origin in the incongruence of the joint bodies or in the severe destruction of the joint. Movement pains are caused by folding up of, and pressure on, the infiltrated and swollen synovial membrane during the slightest emotion in the joint. The traumatization of the nerves lying in the inflammed synovialis calls forth a reflex spasm of all surrounding muscles. The joint, so fixed by muscular spasm, is no longer sensitive, because by the muscular fixation the cause of the pain is removed; *i.e.*, the unavoidable pulling and traumatization of the synovial membrane during movement of the joint surfaces upon each other.

As in this stage of the disease the bone is still intact, fixation causes the joint to be insensitive and weight-bearing painless. In case of pain due to motion, fixation makes weight-bearing painless. It is obvious, therefore, that all forms of tubercular disease of the hip-joint, in which the joint bodies themselves are not affected, are to be treated by fixative dressings with weight-bearing. This dressing shown in Fig. 4, the Lorenz spica, is as a rule changed at the end of the third month; in cases where, on account of the great distance of the patient's home, this is impossible, a dressing of this kind can be left on a year or even longer. This heavily padded dressing is laid on over a tricot and a strip pulled through for the purpose of cleaning the skin. We lay stress on cutting the plaster dressings at the ends and smoothing these cut surfaces, so as not to allow the dressing to become uncomfortable. In this short spica the patient, as a rule, passes most of his time on his feet and without pain. Often enough our coxitis children are seen playing about and jumping with their short dressings. As in these beginning cases the hip-joint is usually fixed in spastic abduction, the lengthening of the leg, due to the abduction position, must be equalized by heightening the sole under the well foot.

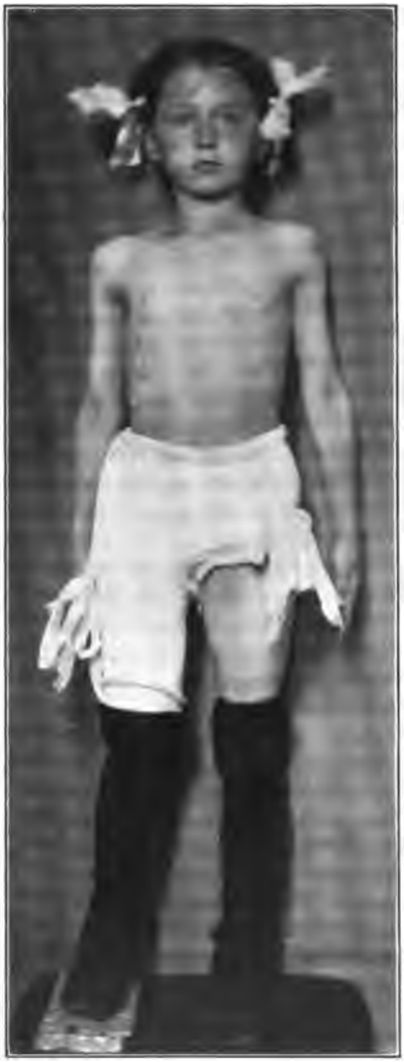

Fig. 4.—Short spine of the hip.

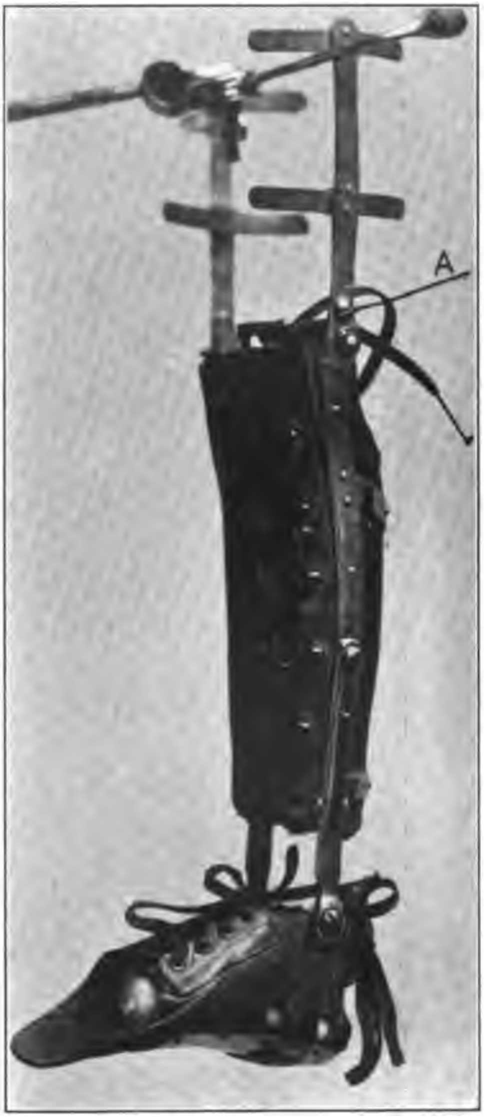

FIG. 5.—Leg apparatus. By removing screw at *a*, it is made movable in the knee-joint.

With increasing bone destruction, sensitiveness of the joint arises, which is not relieved by the short spica dressing. In this case the bandage is augmented by a small mechanical splint,

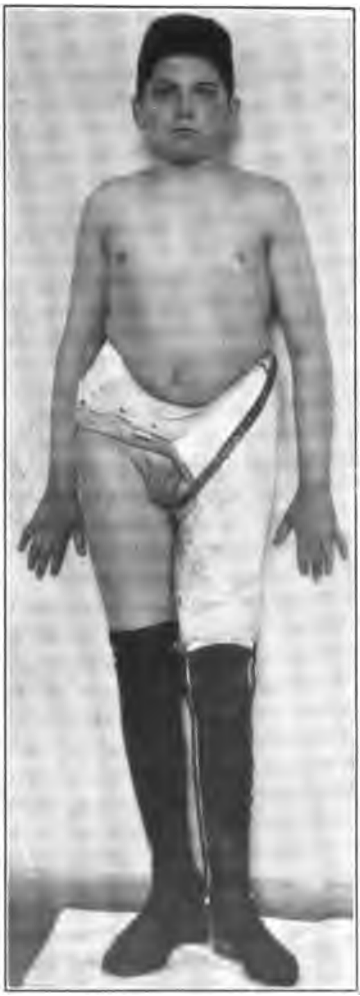

FIG. 6.—Combined dressing I.

Fig. 5, which is made to include the leg and the foot. It is fastened to the hip-cast by starch bandages, and has an arrangement which fixes the knee-joint. In case of necessity the knee-joint can be made movable by removal of a screw at *a*, Fig. 5. With this combination splint, Fig. 6, it is possible to remove

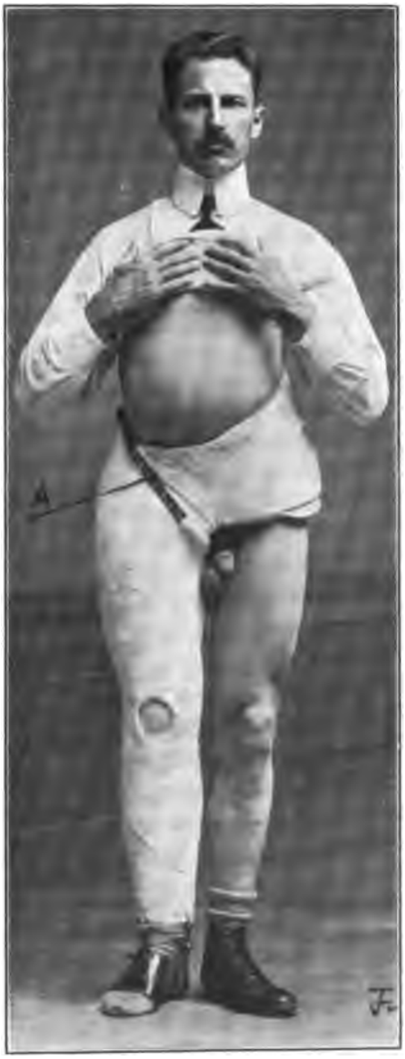

FIG. 7.—Combined dressing II; perineal strap at *a*.

sensitiveness even in cases of greater destruction. If the patient cannot afford the small sum of seven dollars for this leg apparatus, then we lengthen the plaster dressing to the malleoli and add a sandal in a similar manner as in the combined dressing, Fig. 7. The combined dressings, Figs. 6 and 7, were developed from the Lorenz original "Geh-Bügel," Fig. 8, and differ only from this by better appearance and the movement in the ankle-joint. The limb in these dressings is as little suspended as in the Lorenz "Geh-Bügel," but the hip-joint is this way more protected against movement than it would be in the shorter spica. Furthermore, the shock of weight-bearing to the leg is lessened in that the patient rests the leg on the floor by aïd of the sandal. The exact fixation of the hip-joint is attained by the perineal strap as pictured in Fig. 7, *a*.

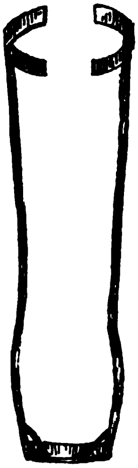

FIG. 8.—The old Lorenz "Geh-Bügel."

There is nevertheless a phase in this disease in which by the above-mentioned means we are unable to relieve the pains; that is, the stage of intraarticular abscess. As is well known, a beginning abscess of the hip-joint is difficult to demonstrate, as the joint lies so deeply covered by muscles and the capacity of the joint is so small that the symptom of fluctuation is of little value. When fluctuation is demonstrable the abscess has already perforated the capsule and become extraarticular. I have also shown that we are sometimes able to diagnose early an intraarticular abscess objectively: normally the posterior capsule lies so on the posterior surface of the neck of the femur that there remains a triangular area outside of the joint capsule, Fig. 9. The examiner here palpates normally a deepening running over into the fossa retrotrochanterica. In beginning abscess of the joint, the capsule bulges here and often fluctuation can be obtained. This symptom is, however, not always demonstrable and it is of double interest to note that failures in our otherwise so successful fixation treatment have led us to assume the presence of an intraarticular abscess. A child, which previously was completely free of pain in its dressing, begins suddenly to cry at night—in the beginning once or twice, later oftener. The pains then soon begin during the day and all our efforts with new dressings, combination dressings, and

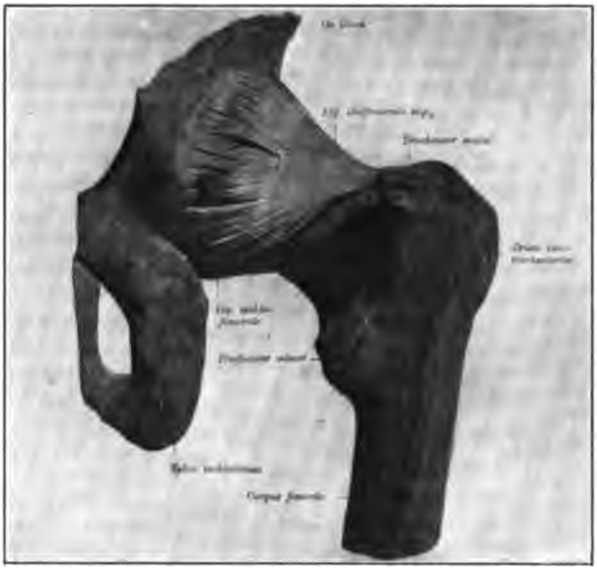

FIG. 9.—(From Ficks, Anatomie der Muskel u. Gelenke.) View of hip-joint from back side. Part of femoral neck lies extracapsular.

even fixation inclusive of the healthy hip, remain ineffective: naturally, because the pain is caused by increasing intra-articular tension. The development of the abscess continues weeks and often months, the child continually racked by pain, which may suddenly disappear over night, in the moment the abscess bursts through the capsule. Luckily we possess in puncture of the joint, in a correctly diagnosed case, a means of shortening and lessening the pain of the patient and by relieving the intraarticular tension, we can immediately by our fixation dressings get the patient on his feet again. In this way it is possible for us in most cases to keep the patient up and about during nearly his whole illness. We do not wish to press the bones against each other by our treatment, as was erroneously supposed by some American authors; we only wish to make the limb relatively painless by fixation and avoid specifically distraction of the joint surfaces. It is doubtless true that, according to Volkmann, traces of pressure atrophy are recognizable in congruous joint surfaces. But also it is as true that the healthy bone surrounding the diseased portions reacts to weight-bearing with thickening of the spongeosa and that the static use of the diseased limb furnishes the most favorable conditions for firm union between the joint surfaces. This latter we strive for above all else. We would not even see a disadvantage to the patient if it were proven that the actual shortening of the extremity be somewhat greater by the weight-bearing method than without it. Each attempt to prove this, however, fails. In fact the real shortening, due to bone destruction by the weight-bearing method, is by no means greater than by the extension method; it is, however, obvious that the impairment of growth, the atrophy of bones and muscles, must be less by our method of treatment because the undisturbed functional use of the limb—as far as weight-bearing is concerned—is always assured. We have often the opportunity to examine patients treated by extension and we have by no means the impression that in these cases the real shortening is little or that there does not occur widening of the acetabulum or dislocation.

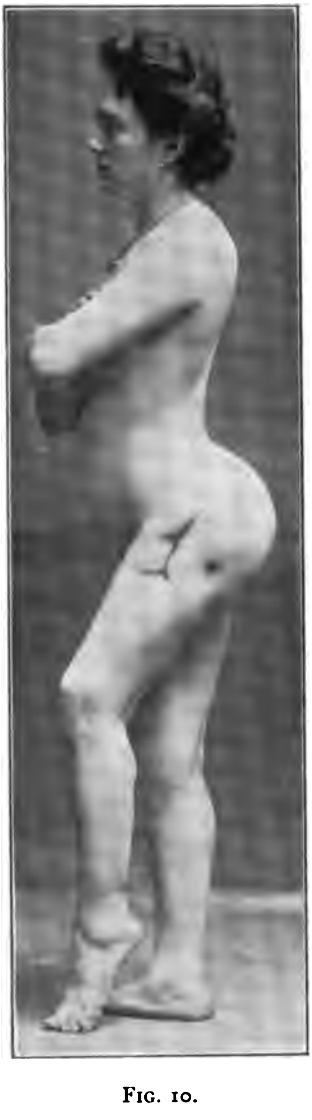

FIG. 10.

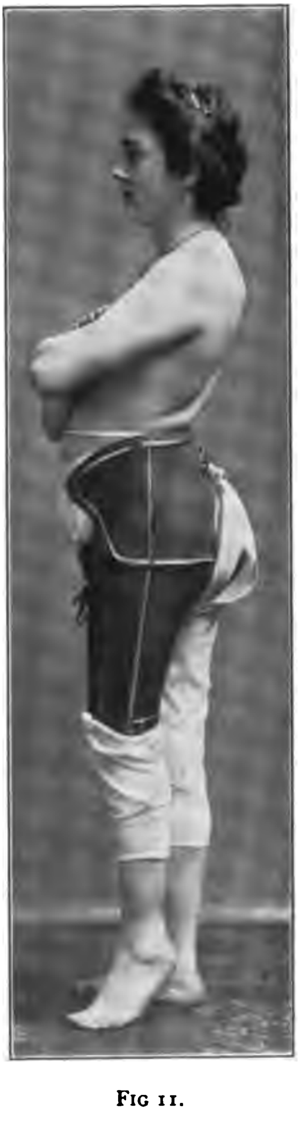

FIG 11.

FIG. 10.—Ankylosis in flexion and adduction. Treated elsewhere.

FIG. 11.—Semicircular apparatus for after-treatment. After correction of the deformity subtrochanteric osteotomy.

In the further treatment, when all local manifestations of the disease have disappeared, we have the patient wear a leather splint made after the model. This is fundamentally different from the so-called Hessing apparatus, and is a common semicircular apparatus, Fig. 11.

At the end of the treatment, therefore, the patient comes with a firm joint. The position, if the patient came under treatment early, is by no means so faulty as to necessitate correction. But even if treatment were begun later and deforming contractured positions were unavoidable, it is possible without the least difficulty to correct it, *vide* Fig. 10. In correction of these positions by subtrochanteric osteotomy, we lay great stress on completely dividing the bone, to obviate in any way loosening the union between pelvis and thigh. In these cases, where ankylosis is incomplete, we fear, in spite of osteotomy, the recurrence of adduction. The more movable the joint, the greater the danger. For these reasons we use in these cases, healed with motion, the splint shown in Fig. 12 with the Lorenz perineal crutch. During the phase in which the patient stands on his diseased limb the pelvis cannot drop down in the sense of adduction because he rides on the crutch.

With these simple means of mechanical treatment just described we believe we are able to do more for the patient than with complicated portative apparatus, or by extension in bed.

Our motto is: *Fixation of the diseased joint without distraction, and the weighting of the fixed joint if at all possible for the obtainment of a functional ankylosis.*

Perhaps some weight may be attached to these deductions by the fact that our observations cover a period of over fifteen years with about 800 cases of tubercular coxitis as forthcoming stastitics of the Lorenz clinic will show.

We might also add that in our opinion weight-bearing by no means favors abscess-formation—on the contrary, we believe that our so conservatively treated cases show less tendency to suppuration. It is interesting to note that in those cases treated from the beginning of their disease there seldom occurs rupture and fistula formation. This is due to the fact

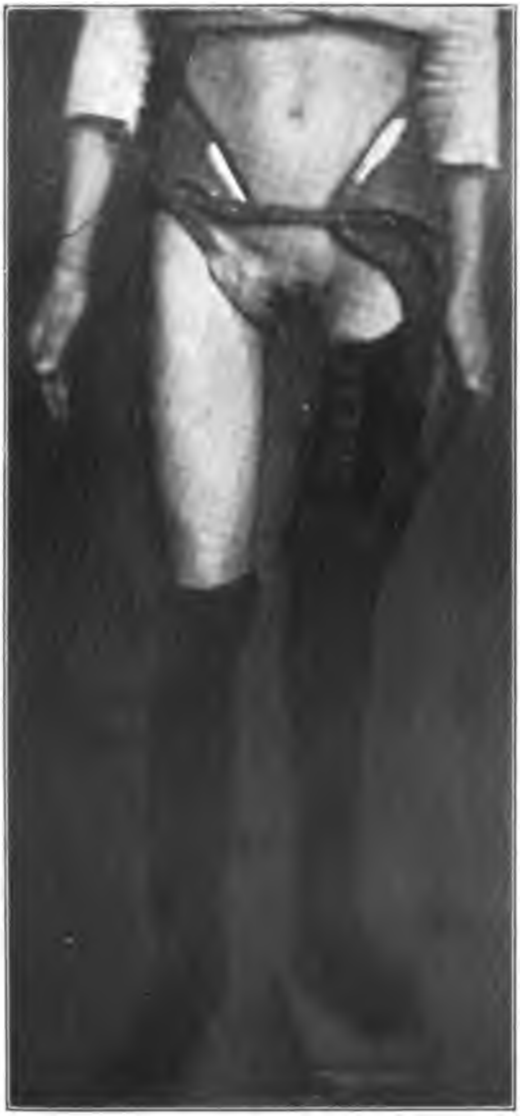

FIG. 12.—Lorenz perineal crutch.

that we never incise the existing abscess, but puncture it, and after puncture apply a plaster cast with compression. In this way the formation of a fistula is always hindered. The blessings of our strictly conservative treatment are great, and we can the better judge it as we also took part in the period of resections—a time when we also thought it possible to shorten the process by extirpation of the diseased tissues with a possible sparing of the healthy bone. We very soon gave up the resection treatment.

In accentuating the great success of the conservative treatment of coxitis, we must not omit to call attention to the importance of combining with the weight-bearing therapy all other modern means at our command in the fight against tuberculosis in general.

Among these, as my latest investigations show, the X-ray treatment promises excellent results in the purely synovial and beginning cases.

XXVIII.

OSTEOMYELITIS AT THE SACROILIAC JOINT WITH GAS BACILLUS INFECTION.

BY SYDNEY M. CONE, A. B., M. D., BALTIMORE, MD.

In discussing Doctor Goldthwait's paper at the 1912 meeting of the American Orthopedic Association I referred to a case, which would illustrate one phase of his paper, where he referred to the hypertrophic arthritis leading to fusion of the ilium and lumbar vertebra. Since then I had occasion to see more of the case, and as a partial autopsy was allowed when the man died a month later, I am able to give some unexpected and interesting facts about the condition.

The case was an obscure one, and many specialists were called on to assist in making a diagnosis.

J. S. Admitted to the Hebrew Hospital medical service, May 21, 1912, complaining of pain in his legs and spine.

Family History.—Mother and father alive and healthy. Three brothers and four sisters healthy. Negative to malignant, cardiac, rheumatic, and nervous diseases.

Previous History.—Usual diseases of childhood, no complications. Negative to typhoid fever, pneumonia, malaria, pleurisy, rheumatism, tonsillitis, etc. Gastrointestinal system negative, bowels regular except of late, slightly constipated. Has had slight cough recently but not for several days. He has lost considerable weight during the last few weeks. No hemoptysis, no night sweats. Genitourinary system negative save at present one drop of whitish discharge after urination; none in the morning. Had gonorrhea twice, the last time three years ago. Negative to syphilis. Does not use alcohol or tobacco.

Present Illness.—Beginning seven weeks ago patient would come home from work tired out and would nearly go to sleep at table eating supper. After going to bed he would remain awake and could not sleep well. Appetite was variable. Continued losing weight. Cough not so marked until two weeks ago when he began coughing rather constantly until three or four days ago. During early part of disease he caught cold while on his wagon, followed by aching of nearly all his joints. This has persisted of late only in his legs and spine. Very constipated. Appetite fair. Does not sleep.

May 21. Eyes examined and found normal.

May 27. Abrasions and fissures in mucous membranes of upper and lower lips. Applied 10 per cent. silver nitrate.

Physical Examination.—Patient rather emaciated. Head negative, no scars nor alopecia. Ears show no tophi, discharge or mastoid tenderness. Nose negative. Eyes: mucous membranes negative save rather anemic; movements good. Pupils equal and respond to light and accommodation actively. Mouth: teeth in fair condition, some pyorrhea alveolaris. Pharynx slightly injected. Small sore on lower lip. Neck: no thyroid enlargement; no tug. Chest: expansion fair and equal; palpation and percussion negative; auscultation shows no râles. Heart: cardiac dullness normal; no murmurs. Liver: dullness from sixth rib to costal margin. Abdominal muscles very rigid; no organs palpable. Inguinal glands palpable. Genitalia negative. Lower extremities well nourished, scar over each patella. Painful area over external thigh regions on deep palpation, also painful on passive motion. Patellar reflexes: right slightly positive; left absent. Babinsky, Kernig and ankle clonus negative. Muscular sense normal; no areas of anesthesia or hyperesthesia.

May 24. Examination [by Doctor Cone: Symmetrically developed, muscular individual. Glandular system hypertrophied; epitrochlears palpable. Joints negative—motions and conformation normal. Flexion of thighs when the legs are extended produces pain along the sciatic nerve especially on the right side. Motion in hip joints free. Spine symmetrical except at the junction of the last lumbar vertebra with the sacrum, where there is a prominence. There is tenderness over both sacroiliac joints. Tenderness on palpation over the line of the sciatic nerves. No external evidence of abscess formation. Tuberculin test and X-ray examination of the lumbosacral region suggested.

June 7, 1912. Anal examination shows tenderness all along the sacrum especially on the left side and along the sacroiliac joint. No especial bulging along the bone. Pressure at any point is referred to the lumbosacral joint. No reference of pain down the leg on pressing at the sacrosciatic foramen. Pressure externally elicits tenderness at similar points. There is slight redness and enlargement over the left sacroiliac joint.

Doctor Smith: Chest examination negative. Heart negative. Cranial nerves negative. Superficial reflexes present. Patellar and tendo-achilles reflexes absent.

Doctor Adler: Upper portion of abdomen somewhat distended; muscle walls thin; movement of stomach easily seen on respiration. Stomach somewhat distended with gas reaches to two fingers above the umbilicus. Upper curvature not demonstrable. No tenderness on pressure. No tumors palpated. Marked scaliness of skin of epigastrium apparently localized; only scaly to a slight extent over the rest of the abdomen. Spleen enlarged; edge easily made out on deep inspiration about 1/2 inch below the costal margin. Stomach normal in size and position; slightly distended. Advised having the urine examined for Bence-Jones reaction.

June 14, 1912. Doctor Randolph: Hemorrhagic neuroretinitis. Hemorrhages more numerous around the edge of disc in both eyes. Pupillary reaction allright.

June 15, 1912. Diplopia present. Weakness of the internal rectus of left eye. Complains of headaches and dimness of vision.

Doctor Beck: Tenderness along the long bones general. Slight glandular enlargement. The temperature averaged 99°, pulse 94 for about two weeks, and toward the end his temperature was 101–102° and pulse 100.

May 7, 1912. X-ray No. 963. Peculiarly shaped vertebræ, tipping suggestive of arthritis. Some displacement of the fourth lumbar vertebra forward.

May 29, 1912. Blood count: w.b.c., 9500; hemoglobin, 80 per cent.; P.N.L., 78 per cent.; large, 1 per cent.; trans., 1 per cent.; small. 19 per cent.; Eos., 1 per cent. Blood culture negative. Widal negative. Wassermann negative. Von Pirquet's negative; 2 mg. old tuberculin injection negative.

June 3, 1912. Blood negative to malaria parasites.

June 7, 1912. Stools negative to ova and Ankylostoma Duodenalis.

June 12, 1912. Blood culture yielded no growth of microorganisms.

Urine: Straw color, acid, specific gravity 1012, no albumin, no sugar. No bile, no Bence-Jones reaction. The patient continued to get weaker, complaining of pain in the back and limbs and on the afternoon of June 19 his pulse became irregular, his temperature shot up to 105° when he died.

Autopsy performed June 20, 1912, eighteen hours after death, the body having been kept on ice. A full autopsy was not permitted. The entire body is distended with gas. Subcutaneous emphysema of body, extremities, face and scrotum.

Peritoneum normal. No adhesions. No abnormalities of the intestines. Walls of colon studded with little gas blebs. Liver friable and full of gas. (I teased material at once and demonstrated gas bacilli.) Spleen crepitant like lung. Gas blebs on outer surface of the kidneys. Kidney substance degenerated. Intestines normal. Heart muscle flabby. Mesenteric glands slightly enlarged. Pelvic fascia and abdominal cellular tissue crepitant.

Bony projections on left side of fourth lumbar vertebra. Anterior aspect of both sacroiliac joints roughened. Anterior aspect of right femur rough. The escaping gas burned with a blue flame.

Anatomic Diagnosis.—General infection due to bacillus aerogenes capsulatus (Welch).

Dr. Macks.
Dr. Hirsch.

I took specimens of bone and tissue from the sacroiliac joints, femur, rib, last lumbar vertebra and sacrum for microscopic examination. The bone was decalcified in 10 per cent. nitric acid and cut. Some was examined without decalcification.

All of the tissues were imbedded in celloidin and cut with the microtome while some were teased or cut by free-hand method. The medulla of all the bone pieces was teased on a slide and stained with methyl blue and gentian violet, then mounted in glycerine. In all of these specimens bacilli of the morphology of gas bacilli were seen in great numbers. No other bacteria were noted. Most of these bacilli were rounded at the ends, some were square and many were in chains of two and three. Spores at each end were noted in all of them and they were encapsulated. They appeared about 6 microns long and 2 microns thick.

Sections of the irregular bone at the sacroiliac joint shows some necrotic nonstaining bone on the border. The medulla and surface is a dense mass of round cells which for the greater part stain fairly well but in areas are massed in a nonstaining more or less homogeneous mass (necrotic). The bone lamellæ are broken and nonstaining at these areas but elsewhere stain well. Small granular pieces of necrotic bone lie imbedded in masses of round cells. Nonstaining bacilli such as described above are seen in these decalcified specimens. The specimen labelled fifth lumbar vertebra (decalcified) is mostly ligament whose fibers are separated by densely infiltrating masses of round cells. An unusual amount of hemorrhage has occurred here and many gas vacuoles, large and small, separate the fibers of connective tissue. Blood pigment and nonstaining bone spicules are seen among the infiltrating cells and connective-tissue fibers. Nowhere do we see an attempt at progressive tissue change.

The specimen of ilium with muscle attached at the joint: Some of the muscle is intact, some is infiltrated with round cells fragmented and nonstaining. The bone shows areas of necrosis fragmentation, rough and nonstaining areas. Loose necrotic pieces lie imbedded in masses of round cells. The medulla is a dense mass of round cells and polymorphonuclear leukocytes and many large vacuoles. Some areas do not stain at all. Large bacilli in pairs are seen in this infiltrated muscle and marrow. The bone cells are pigmented with blood and both granular and crystallized pigment is seen.

Sections of the rib and femur show no change in bone structure, but the marrow is a mass of round cells. No necrosis is noted in them.

Muscle at the sacroiliac joint teased, stained and mounted in glycerine shows round-cell infiltration, vacuoles and a granular condition. The same bacilli, morphologically like the bacillus aerogenes capsulatus (Welch) are seen in these specimens. Teased specimens of nondecalcified bone verify the findings in the cut sections. While the autopsy was in progress I took some of the liver substance, teased it as I treated the muscle and bone marrow later and demonstrated the same bacilli.

To determine what relation the gas bacillus had to the disease and death of the patient is not easy, for we have few cases where it was demonstrated in the blood during life. That it may be an essential factor in the cause of death has been demonstrated by experimental work as well as by reports of numerous cases where it was introduced into the body through open wounds. In Welch and Nuttall's original communication, after describing the bacillus and its cultural characteristics, experiments on rabbits and guinea-pigs were described. It was not proven virulent to rabbits except in one case where the rabbit contained two dead embryos in its womb. In this case the rabbit died with gas development throughout its body. In the other inoculations the rabbits lived but when killed developed gas throughout the body. The sooner they were killed following the injection of the bouillon cultures the more extensive was the formation of gas, if the animal was kept at 30° C.

Injection of rabbits postmortem showed no development of gas bacilli far from the point of injection. Injection of guinea-pigs caused local necrosis like in human beings with general infection and death as a rule.

In their case of aneurysm of the aorta which showed gas bacilli and emphysema throughout the body ante- and post-mortem, it was judged that the bacilli developed in an old clot and spread therefrom antemortem.

Most of the cases in the literature follow trauma in which the open wound was exposed to dust, dirt, intestinal contents or urine. One described by Herring and Reuhling followed a ruptured appendix, another (Dunham) an ischiorectal abscess with rectal communication, others urethral structure (Dunham) and suprapubic cystotomy. One was a jaw case where infection occurred by the mouth, an abscess communicating with the tonsil. Others (Dobbin, Dunham and Stewart) were vaginal infections. In some the origin of the infection is unknown, but as Welch and Flexner showed the wide distribution of the gas bacillus in the earth, intestinal tract, dust of the rooms and feces, it is easily seen how infection could occur.

One notable fact in all of the cases is the difficulty with which the bacillus gets a foothold in the general circulation. Very few of the 187 cases collected by Cramp in his painstaking search through the literature were generalized through the circulation. This might be in part because it will not grow under aerobic conditions or did not find favorable food for its growth. In Welch's original communication he suggests that the favorable opportunity for growth and spread was the aneurysm clot in one case and the dead fetuses in the rabbit's womb in the other. There have been a few other cases in which the gas bacillus was found in the blood antemortem, one of Gwyn where thirteen days before death they were grown and shown in the blood of a case of chorea insaniens. Here the only local evidence of inflammation was a swelling of the parotid gland. Graham, Stewart and Baldwin's case is referred to in Welch and Flexner's work. Rufus Cole demonstrated the bacillus in the circulating blood during life in a case of traumatism of the thighs. In neither of these cases was gas found in the body during life and in Gwyn's case it did not develop later. Bloodgood reported two cases due to the gas bacillus where no gas was present. It looks as if the gas bacillus develops differently under varying conditions. Welch noted that there is occasionally seen a bacillus like the gas bacillus which grows under aerobic conditions. Bloodgood in a personal communication mentioned the difficulty of growth in the body at any distance from the original wound. In his communication, Cramp shows the relative ease of ridding the local wounds of the bacillus by wide exposure and oxygenation. Blake and Lahey believe the infection to be held in check by normal blood and tissues. Lahey says that the bacilli are very numerous near the wound but are not present far distant although the tissues there be much diseased. He also states that when gas bacillus infection is once well established its progress is rapid destructive and certain to result in death without treatment.

Blake and Lahey say of the infection: "In general the picture of a case of gas bacillus infection is like this; there is no pain, delirium is a late symptom, nausea and vomiting may be present. Constitutional symptoms of other infections are not usually present until the infection is extensive and beyond control. The lymph glands are not tender and enlarged. There is no reddening and induration of the lymph channels, no development of fresh processes situated apart from the original infection."

A case described by Bloodgood is interesting as showing the insidious manner in which the infection may spread:

Male, aged thirty-five. Suffered contusion of the buttocks and thigh eight days before entering the hospital. Five days later he complained of pain along the sciatic nerve. There was no external evidence of injury. His temperature on entrance was 101, pulse 85. Upper third of thigh swollen posteriorly, tenderness but no emphysema developed. Skin not red or edematous. Deeper tissues infiltrated. Joints not involved. Rectal examination showed fullness on right side of rectum 4 cm. above sphincter. Eight hours later emphysema was observed in the popliteal space. Incision showed pus which came from the great sacrosciatic foramen. Gas, pus and necrosis at operation and autopsy. Gas bacilli in the wound and in the lungs but not in the blood or organs. Infection came from the rectum where two perforations were found.

A study of our case indicates a low-grade infection slowly getting the upper hand. The most prominent symptoms were his leg and back pains and prostration. Final hemorrhagic neuroretinitis and diplopia. The blood examination excluded syphilis, tuberculosis, malaria and nothing grew on ordinary culture media. The urine was normal. Examination of the stools negative to ova or intestinal parasites. Nothing besides the bone findings and the generalized gas bacillus being found at autopsy one would think it worth while in similar cases to make anerobic blood cultures.

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DISCUSSION.

Dr. L. W. Ely, Denver.—I had a case of gas-bacillus infection that I did not discover until after the patient was dead. After an operation for ununited fracture of the tibia and fibula, the patient complained of great pain in the shoulder; and, for the first day or two, I thought that he was scared to death. A culture made from his wounds showed that they were all right. The patient, however, got worse and died, and it was only at the autopsy, which was performed in order to find out why the death had occurred, that I found the gas bacillus. It was a great surprise to me. In that case, there was crepitus in the wound. The gas was around the wound, and this led us to suspect its origin.

XXIX.

THE USE OF CELLULOID FOOT PLATES.

BY EMIL S. GEIST, M. D., MINNEAPOLIS, MINN.

While in Munich in 1905, I was impressed with Lange's method of using celluloid for various orthopedic appliances, especially his foot plates. On returning home, I began following his directions; absolutely duplicating his product.

I soon discovered that this was impractical as it did not fit well into American shoes, whether for men or women. After some experimenting with different styles and shapes, I have come to use (in most of my cases of weak foot) a foot plate such as you see here. Nothing original is claimed for it, neither as to shape or material. Whether others are using a similar foot plate made of culluloid, I do not know.

The plaster model is made following Lange's method of allowing gentle weight bearing while the plaster is hardening. I have tried most of the various methods recommended of making an accurate model of the foot. I believe, however, that they are all accurate only to a certain degree. From what I have been able to observe, they are all trimmed and shaved rather empirically, each orthopedist using his own judgment as to how much of this is necessary. I therefore have returned to the easiest method of making the approximate copy of the foot, the model, by the use of rolled plaster bandages.

The arguments *against* this celluloid foot brace are that it is fragile, brittle and inflammable. That it is brittle and fragile, is no doubt true. However, I find in actual work that the life of such a brace is between six months and one and one-half years, which is certainly long enough.

The advantages which, to my mind, far out-weigh the disadvantages, are the following:

First, they are of exceedingly light weight. This, to my mind, is a great and real advantage and is appreciated by all of the patients who have come in with metal arches.

Second, they look absolutely different from anything which the patient has heretofore received, or bought at the shoe store. Ninety per cent. of my weak-foot cases come to the office wearing some form of metal support.

Third, they are inexpensive.

Fourth, they are easily made; an office attendant can very easily be trained to make them.

Fifth, they fit accurately and are exactly of the desired shape, when completed.

The method of constructing this brace is simple. The plaster model is shaved and smoothed to the desired degree. Heavy tape is applied longitudinally to the model by means of a little celluloid—the celluloid, of course, being in the form of a thick solution in commercial acetone. Three or four coats of acetone celluloid are then applied and allowed to dry.

Following this, a number of strips of band steel of proper length are placed longitudinally and tied on with fine shoemakers' string, the number of steel strips varying with the weight of the patient. More celluloid is applied. Then comes another layer of tape, this time at right angles to the first layer, more celluloid being applied after this. The whole is allowed to dry twenty-four hours, when it is easily removed from the model and trimmed to suit.

I have discontinued lining, or covering, these braces with leather as I find they are cleaner and more easily worn just as shown here. A few of my patients prefer to wear the braces inside of the stocking. The great majority of them, however, wear them between the stocking and the shoe. I have used these braces in approximately 1,000 private cases.

This is not offered to take the place of the other well-known methods of treating weak-foot, such as massage, exercises, the use of proper shoes, etc. In my work, I avoid the use of braces wherever possible. When braces are needed, I find this form very acceptable and satisfactory in most cases. However, this celluloid brace does not in my practice totally supplant the excellent shapes and forms of braces originated by *Hoffa* and *Whitman*.

XXX.

RECUMBENCY IN THE TREATMENT OF POTT'S DISEASE.

BY GEORGE B. PACKARD, M. D., DENVER, COLO.

My apology for writing a paper on this well-known method of treatment in certain cases of Pott's disease is the fact that we see so many pitiable deformities in the dorsal region, at the present day, in spite of the fact that our attention has been repeatedly called to the importance of recumbency, as an almost necessary measure to prevent deformity in this location. I wish, therefore, to emphasize this method of treatment as a most valuable measure, particularly in the middle and upper dorsal region and also in other regions of the spine where the Patients seem to be well supported, but tire easily in the upright position, and frequently desire to lie down, and also in cases where abscess and paralysis are developing.

It is to be hoped, and it may be possible, that the recently devised operative measures will succeed in quickly arresting the diseased process and preventing deformity.

Until such results are assured facts it will be well to carry out this treatment most carefully, and for long periods, if the patient's general condition improves.

In order to arrest disease in vertebral tuberculosis and thus prevent the resulting kyphosis, it is necessary to immobilize the spine, diminish the pressure between the bodies of the vertebræ, and improve the general nutrition.

In the cervical and lumbar portions of the spinal column the convexity of the curve is forward; therefore the superincumbent weight is largely transmitted through the posterior portions of the vertebræ; in the dorsal region the normal curve of the spine is posterior and hence a forward concavity exists and there is consequently more pressure between the bodies of the vertebræ.

No mechanical device for relieving this pressure is equal to the recumbent position.

Even though the dorsal vertebræ are firmly bound and secured to each other by the ribs and sternum yet the constant traumatism of respiration has a tendency to favor activity and deformity.

In the upper dorsal region we not only have difficulty in applying the principle of leverage to the part, but we have the weight transmitted through the bodies of the vertebræ upon the concave and weaker side.

Under these circumstances deformity is almost sure to take place, if the patient is in the upright position, during the active stage of the disease.

The mechanical problem is, therefore, very different from that in the lumbar and cervical region. In order to prevent movements and jars of the spine and also to reduce the pressure between the bodies of the vertebræ to a minimum, while the patient is recumbent, I regard as most important that a rigid back support should always be used in conjunction with the Bradford frame. This support has also the additional advantages of preventing any possible sagging of the spine and of allowing the patient to be changed to the prone position with impunity for inspection and cleansing of the back. Perhaps the most comfortable and efficient support for this purpose is the posterior half of a plaster jacket applied with the spine in a hyperextended position.

In many cases where the kyphos has already developed recession will gradually take place. Felt pads can be placed under the kyphos, within the jacket, whenever it seems advisable to increase the pressure.

Experience proves that enforced spinal rest which is best attained by recumbency improves nutrition. If the patient has the additional benefit of fresh air, sunlight, and good nourishment, the active tuberculous process will soon become arrested and the pain and nervous irritability will disappear. The patient puts on fat and the face soon loses the pinched and anxious expression so often seen in Pott's disease.

The patient thus treated can be kept in the open air protected from the elements, and also from the fatigue incident to exercise, many more hours of the day, than when treated by the ambulatory methods.

The fact that paraplegia, or partial paralysis, is most successfully treated by horizontal fixation, the only treatment in fact that is efficient in such cases, is strong evidence that it more thoroughly immobilizes the diseased area and affords better protection against jars and concussion than any other mechanical means. The favorable results reported by Dr. Calot of Berck in the treatment of this disease are unquestionably due to recumbency and outdoor life.

He has modified the ordinary plaster jacket by uniting the back and front over the shoulders and if the disease is above the ninth dorsal, the neck, chin and occiput are included.

He also cuts out a fenestra over the kyphos, through which cotton or felt can be introduced, either side of the spine, to increase pressure and to prevent or diminish deformity. The writer, however, on a recent visit to Dr. Calot's institution observed that he kept his patients recumbent and in the open air in addition to the plaster jacket.

Another point worthy of consideration in this connection is the growth of the body. With horizontal fixation it is practically normal and for this reason the periods of recumbency should be prolonged until contraindications arise.

When the patient, with disease in this location, is up and around, with protective appliances, the growth of the trunk is very apt to be checked, even though the pain and discomfort are relieved.

During recumbency the patient should have general massage, daily, to keep up the tone of the unused muscles, and to improve the general nutrition.

In most cases this treatment can be continued for one year and many times for eighteen months with marked benefit to the patient. After this length of time it is well to allow the patient to gradually get about with protective apparatus and to return again to recumbency at the first indication of active symptoms.

Many consider this treatment too exacting to be successfully carried out. This has not been my experience. After the first few days I have found very little difficulty. The poorer cases are not accustomed to much attention and consequently give us very little trouble. The better class will require more careful nursing and amusing and if there is any difficulty in controlling the patient at home a temporary sojourn in a hospital away from home influences will soon accomplish the desired effect. This treatment is particularly adapted to the middle and upper dorsal regions. It is also of great value in other locations, as a means of diminishing intervertebral pressure, and the shortening of the body. Horizontal fixation is usually recommended in infancy and early childhood.

I have never seen other than excellent results, however, in older children; in fact during the period of growth, when the structure of the spine is less resistant and deformity apt to result. Recumbency is not so successful with adults, except in cases of paralysis. Confinement is irksome and there is little fear of deformity.

When recumbency is resorted to in adults they should have the benefit of outdoor air day and night.

The writer considers it unnecessary to go into details of the different methods of ensuring complete rest, but simply wishes to call attention to the fact that deformity exists in Pott's disease too frequently, and from his experience in the last few years with horizontal fixation and extension when necessary, he has been able to secure far more satisfactory results than in former years when he relied more particularly upon ambulatory methods.

With thorough attention to details in carrying out this particular method of treatment as long as the indications require it, and with the patient in the open air, deformity can be prevented and even when present in nonankylosed cases it can be diminished.

XXXI.

THE PATHOLOGY OF TABETIC ARTHROPATHY: PRELIMINARY STUDY OF TWO CASES.*

BY LEONARD W. ELY, M. D., DENVER.

In view of the difference of opinion which exists as to the nature of this lesion, after many years of clinical study, the necessity of laboratory study is apparent.†

Three views have been strongly held: First, the lesion is essentially "arthritis deformans" modified more or less by the cord lesion; second, the damage to the trophic centers in the cord is the main causal element. Degeneration of the nerves in the limb is a fairly constant phenomenon, but this degeneration has also been found on the sound side. Third, Charcot's joint is simply a late syphilitic degeneration of the marrow and synovia. While two cases are insufficient basis for a definite opinion, I strongly incline to the third view.

MORBID ANATOMY.

One feature is especially prominent, the wild disorganization of the joint, a grotesque mixture of tearing down and of building up, which changes completely the architecture of the articulation. In the hip and shoulder destructive changes are said to be more prominent, in the ankle and elbow productive changes. In knee-joint disease the femur is said to show usually the former, the tibia the latter. The articulation is often filled with fluid—serous, fibrinous, or bloody—and contains fragments of bone and cartilage, free or attached. The bone ends are changed in shape, not only by wearing away, but by fracture, and the fractured pieces may lie in the joint. Masses of new bone and cartilage may be built up at the periphery, and may be deposited in the neighboring muscles, ligaments and tendons, and also in the synovia. The cartilages may be eroded, or may be replaced in part or in whole by fibrous tissue.

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* From the laboratory of the University of Colorado.

† The examination of these joints was made under the direction of Dr. Ross Whitman, Professor of Pathology at the University.

The synovia is thickened, contains deposits of bone and cartilage and in places forms "tabs" in the joint. The menisci disappear. The ligaments may be stretched, torn or destroyed. Flail joint, subluxations and luxations result.

Case I.—This was a resected left knee which had been treated for some time as chronic synovitis. No attempt at union ensued on the resection and an amputation of the thigh was done two or three weeks later. Death occurred shortly afterward.

The specimen is the entire knee-joint, so distorted that the various portions of it can be distinguished with great difficulty. The femur had evidently ceased to articulate with the tuberosities of the tibia, and had been subluxated backward and to the inside. The condyles are gone, and the end of the femur appears as a long rounded piece of bone, like a roller, with the long diameter antero-posterior, covered by fibrous tissue. The cartilage has practically disappeared.

The joint presents a series of pockets in which are large "tabs" of degenerated synovia.

The patella is changed in shape, and feels thickened and rounded in its internal portion and thinned to a shell in its external.

The tibia has lost all aspect of a normal tibial head. The crucial ligaments and the semilunar cartilages are gone. The whole inner side of the head of the tibia has been worn away, giving the joint a slope from without, downward and inward, and forming an antero-posterior groove with which the femur end articulated. The cartilage, though thinned, seems present at the central portion of the joint, but is eroded at the periphery. A feeble attempt at bony production is present at the external margin of the external tuberosity. The internal portion of the joint is obliterated by fibrous tissue tightly attached to the bone.

Microscopical Examination.

Femur.—The cartilage is replaced by young fibrous tissue, containing blood pigment. Congestion of blood-vessels (stasis) is present. Rarefying osteitis is present directly under the replacing fibrous tissue. This fibrous tissue, if traced to the side, is seen to end in the synovia. The marrow itself in places appears almost normal, except that it partakes of the nature of fatty marrow. In other areas the marrow is replaced by fibrous tissue, which is continuous with that at the surface of the bone. Either the fibrous tissue has broken in from the surface, or broken out from the interior of the bone. The latter is much more likely. At one place immediately beneath the joint surface is a "focus" of fibrous tissue, about 20 mm. in diameter, which reminds one of a tuberculous focus. It is composed of new fibrous tissue continuous with that covering the end of the bone, and is surrounded by thickened bone trabeculæ. Apparent at one place in this "focus" is an area of new bone production, shading off into osteoid tissue. Near this is a collection of round cells. The blood-vessels are engorged. The trabeculæ about the focus are undergoing a productive osteitis.

Tibia.—Productive osteitis is marked. Collections of mononuclear leukocytes can be seen in the marrow, especially about the dilated capillaries. Many of these carry blood pigment—absorption of exudation. Some replacement of cartilage by fibrous tissue, as in the femur, has taken place. This fibrous tissue is continuous with the synovia at the border of the joint, giving the impression of an extension of the synovia at the expense of the cartilage. One area of cartilage remains near the border.

Synovia.—The synovia is thickened, but not hyperplastic. It consists largely of rapidly growing granulation tissue. The endothelium of the blood-vessels is prominent. The membrane contains many vascular spaces—some filled with blood. Some capillaries are surrounded by round cells. Villous hypertrophy is marked. Blood pigment is abundant in the membrane. Some of the blood-vessels have thickened walls. In places the new connective tissue has undergone hyaline degeneration near the surface.

The main features of the process in the synovia are: 1. The enormous connective tissue proliferation—a low-grade inflammation; 2. an increase of the vascular spaces; 3. hemorrhages.

Summed up, the process in the joint appears to be an eating away of the bone, by the cells of the diseased marrow, with a feeble effort in one area toward the production of new bone.

The marrow of the tibia and femur, stained by the Levaditi method did not show the presence of the treponema pallidum.

CASE II.—*Ankle.*—This was a case that had been curretted and gouged out without a correct diagnosis. Later, an amputation was necessary.

Specimen.—Lower three-quarters of tibia and fibula, and the talus and calcaneus.

The lower end of the tibia is badly damaged. Evidently the inner malleolus had been chiseled away, and the joint scraped. The specimen is rather dry from neglect.

The ankle-joint, the talocalcaneal and the talonavicular joints seem all involved, the first most severely. The joint cartilages are eroded. The ends of the tibia and fibula are so dry that an exact description of their joint ends is not possible. The tibia appears badly eaten away.

The talus and calcaneus are rather hard to cut, the tibia and fibula are not so hard.

Microscopical.—Sections from the tibia and fibula show practically no lymphoid marrow. Fibrous tissue and fat have replaced it. The bone is largely necrotic, and shows no sign either of productive or of rarefying osteitis. The cartilage in places is badly degenerated, and in places is replaced by fibrous tissue.

Talus.—Its navicular and tibial articulations. The cartilage is degenerating, but shows no sign of any fibrous change, and is not nearly as badly affected as is that of the tibia. Many of the bone trabeculæ are dead. Some show signs of rarefying osteitis. The marrow shows a fibrous change, but contains many marrow cells, including large numbers of megaloblasts. In places it shows hemorrhages.

The marrow, stained by the Levaditi method, did not show the presence of treponema pallidum.

From the study of these specimens we can obtain a fair understanding of the clinical phenomena of the disease. The morbid process may exist in the marrow for a time without symptoms. Then suddenly the cartilage is perforated, and the joint swells up, and fills with fluid. If no extensive bone destruction have taken place, the symptoms may subside, to recur later as the disease advances, otherwise the march is fairly steady. Pieces of bone, killed by the disease in the marrow, are separated and thrown out into the joint. The destruction of portions of the articulating bone ends is responsible for the change in the architecture of the joint, and causes the distortions, the subluxations, and the well-known laxity. The loose bodies in the joint are the broken-off pieces of dead bone.

Many of these strange joint lesions lose their mystery when we put the specimens under the microscope.

XXXII.

CERVICAL RIB:*

REPORT OF THIRTY-ONE CASES.

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Cervical ribs are congenital bony deformities. They may be looked upon as a tendency to atavism. Every vertebra in certain lower forms of limbless vertebrates has ribs attached to it, but as we ascend the scale to the limbed vertebrates we find the ribs normally restricted to certain definite vertebræ. Occasionally in man lumbar ribs are found but they are of anatomic rather than clinical significance, since they rarely if ever give rise to any discomfort.

Until within the last twenty-years the cervical ribs that were recorded were considered anatomic anomalies only. Their presence had been noted by Galen in 1740 and perhaps the first authentic description was that of Hunwauld published in 1742. A comprehensive description and classification was written by Gruber in 1849 in which he brought the reported cases up to seventy-six. In 1894, Pilling collected 139 cases and reported them. Only nine of these had been recognized during life. Since the Röntgen rays have come into use, however, the deformity has been recognized during life quite frequently.

The literature on the subject of cervical rib is abundant and that which was previously considered an anatomic curiosity has become established as a well-marked clinical entity. The anatomists reporting these early cases assumed that individuals thus affected had shown no symptoms during life. This was probably true in the majority of instances, but undoubtedly many had symptoms which to-day would be diagnosed correctly, and the condition relieved.

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* Read before the Am. Orthop. Assoc., Wash., D. C., May, 1913.

In 1907 Keen(5) published a paper on Cervical Rib and reported a case. It stands to-day as probably the best monograph on the subject in America.

While cervical ribs are congenital deformities they rarely give symptoms until adolescence and well into adult life. There is no satisfactory explanation of why this is so, but probably they are slow of growth. In youth also we have greater elasticity of all tissues, and structures adapt themselves more readily to displacement. As an explanation for individuals complaining late in life Keen suggests that as we grow old the tone of the muscles is lost and the shoulders droop, thus increasing the angulation of the structure passing over the rib.

The deformity is usually bilateral. Of thirty-one cases observed in the Mayo Clinic there were twenty-four bilateral. All the cases in this group in which there was undoubted elongation of the costal process on each side of the seventh cervical vertebra beyond the tip of the transverse process of the first dorsal vertebra were classified as bilateral. Nine of the twenty-four were well-developed bilateral cervical ribs, ten were rudimentary bilateral cervical ribs and three had a well-developed rib on the right side with an accompanying rudimentary rib on the left. Two cases had a well-developed cervical rib on the left side with an accompanying rudimentary on the right. None of the males presented well-developed bilateral cervical ribs while of the ten presenting bilateral rudimentary ribs six were males. There were five patients with well-developed left cervical ribs, the right being absent, whereas there was only one developed on the right side alone. Of the nine well-developed bilateral cervical ribs only two caused subjective symptoms and but one was operated on. In this case the left rib which was the larger was removed. The entire nine objectively presented tumors of varying sizes in the supraclavicular fossa. Of the ten bilateral rudimentary ribs three patients had subjective symptoms; in one of these patients the rib was removed. For some reason unexplained cervical ribs are more common in women—twenty-two females and nine males in this group. In literature on the subject the percentage is usually rated as 70 per cent. of females and 30 per cent. of males.

It is believed by some observers that heredity has a bearing in the history of these cases but this fact has not been noted in our observations. The occurrence of the deformity in connection with some other is often noted; in none of the thirty-one cases, however, was there any accompanying deformity. Marburg, Oppenheim, Borchardt, and Schönebeck reported cervical ribs in connection with syringomyelia, a condition for which it is frequently mistaken. Spiller and Gittings found the condition in a case of progressive muscular atrophy of the cervico-bulbus type. Levi found it in a case of multiple sclerosis. These conditions may all have some bearing on the deformity but probably are merely coincidents. It has been pointed out that scoliosis is quite commonly associated with cervical rib. Hibbing examined 400 cases of scoliosis by X-ray and found cervical rib in 2 per cent. The condition was not present in any of our cases.

As regards the relative frequency with which cervical ribs occur no definite data can be obtained. Thirty-one have been recorded in the routine examination of approximately 80,000 patients in the our clinic during the last five years. The chests of the patients are always examined and any deformity in the supraclavicular fossæ would be detected. Yet in the thirty-one cases there were eighteen who gave no subjective symptoms. On physical examination seven of these eighteen patients displayed a fulness in the supraclavicular fossa of which they may or may not have been cognizant. These patients were subjected to X-ray. Eleven of the eighteen did not show a tumor, though after the X-ray had revealed the cervical rib a little fulness in some of the cases was detected in the supraclavicular fossa. This latter group of eleven cases had all been subjected to an X-ray examination of the chest for some other reason, *e.g.*, suspicion of tuberculosis, enlargement of the heart, substernal goiter, suspected aneurysm, etc. In none of them could the symptoms be attributed to the presence of the extra rib.

The lack of symptoms in the cases of this group is not to be accounted for by the age of the patient since their ages ranged from nine to fifty-one, with an average of thirty in the eighteen cases. Undoubtedly, there were many patients who passed the routine examination in the clinic in whom cervical rib was present though not suspected. The chest not being X-rayed for any other reason the condition was not discovered. At any rate more than half the patients in our series gave no symptoms subjectively. The condition was discovered accidentally in the course of routine examinations.

Of the total number of patients (thirty-one), six gave symptoms subjectively and objectively, but were not operated on. In some instances operation was not advised owing to the absence of severe symptoms and in others it was declined. The ages of the patients varied from nine to sixty. The patient sixty years of age (a woman) had had symptoms since she was fourteen. At the onset the pain in the left shoulder and neck was severe and continued for two years. The condition was not diagnosed and she gradually recovered to be troubled only at intervals. There was present some atrophy of the left shoulder girdle, the whole arm and thenar eminence, the arm being used with care. A tumor was noted about the time of the onset of symptoms.

Seven of the patients (five females and two males) were operated on. Their ages varied from five to forty-nine years. The rib was excised in six of the cases; the other, a neurotic man aged thirty-nine, had alcohol injection and cautery to the neck. Both ribs were not removed in any of the cases.

On reviewing the literature one is impressed by the wide range in the variety and degree of symptoms. A great many of the cases are diagnosed as brachial neuritis. In only two of our series had a correct diagnosis been made previously. A persistent neuritis over a term of years is usually the prominent symptom. A simple neuritis will have cleared up, as a rule, in a shorter time. Persistent neuritis in conjunction with a hard bony fixed tumor in the supraclavicular fossa on the affected side is almost positive evidence of the existence of a cervical rib, but the diagnosis can only be clinched by the X-ray.

In an endeavor to account for brachial neuritis from an anatomic point of view, Jones intimates that persistent brachial neuritis may be caused by conditions other than cervical ribs, arguing his point from an embryologic standpoint. In the lower forms of vertebrates, the reptiles, a rib is attached to each vertebra. As we ascend the scale to the lizards, a neck, waist and limbs have developed. With the development of the limbs has occurred a sacrifice of ribs opposite those segments from which the limb arose. In the cervical region in man there might arise a certain lack of harmony in the point of exit of the nerve roots and the first rib. An individual might have the normal number of ribs but the nerve roots make their point of exit a little low and the first dorsal rib rise a little high. The result would be pressure on the nerves and a brachial neuritis. Various degrees of this condition might be present. In certain cases the cervical ribs do not give symptoms and here again the nerve roots may make their exit high and so escape pressure. If their exit be low or normal pain will ensue.

Before considering the symptomatology of these cases a brief résumé of the anatomy is essential. Cervical ribs usually arise from the seventh cervical vertebra which was the origin in all our cases. They are usually bilateral. Occasionally they arise from the sixth cervical vertebra also. There is a marked variation in size and it is impossible always to judge from the X-ray as to their length. The vertebrocostal articulation also varies. It either articulates directly with the vertebral body or with the disc. If the sternal end is free it may be movable. We know that embryologically each cervical vertebra has a costal process which, with the transverse process, forms the costotransverse foramen. The cervical rib arises as a result of the abnormally great development of this costal process, which process is traceable on all the vertebræ and in the thoracic vertebræ furnishes the normal ribs (Fig. 1). In the sacral segment it is so altered as to be scarcely recognizable.

Gruber's classification of these cases is the one generally adopted on account of its simplicity. He divides them into four groups as follows: (1) a slight increase in the costal process, not reaching beyond the transverse process; (2) when the rib protrudes beyond the transverse process to a certain degree and either terminates in a free end or is attached in some way to the first rib; (3) those ribs which extend well beyond the transverse process and a considerable distance toward the first rib even reaching the cartilage of the normal first rib—they possess a good body and are often united by a ligament to the first costal cartilage; (4) the rib which is completely developed articulating with the first costal cartilage and with the sternum. In compiling this series the author has not called the cases coming under group one of Gruber's classification cervical ribs.

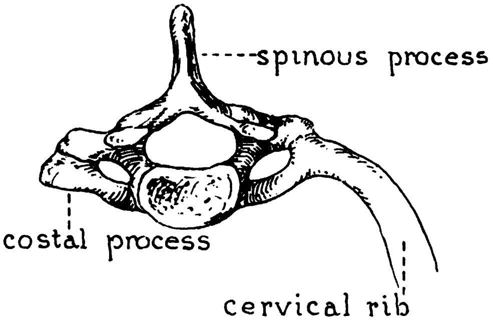

FIG. 1.—Showing abnormal development of costal process into cervical rib. (From Morris' Anatomy.)

Cervical ribs infringe on the territory of very important structures—the brachial plexus, the subclavian artery and vein, and the pleura. The pleural dome rises up into the neck, lies close to and is practically attached to the periosteum of this rib. It may be opened during operation, producing some degree of pneumothorax. This occurred in one of the cases in this report—the youngest, a child of five years—with no untoward result. The relation of the artery largely depends on the size of the rib. If the rib is short the artery runs in front of it, if of fair size it courses over it but never has been noted to run underneath the rib. The scalenus anticus muscle is in front of the artery thus placing the artery in a cramped position

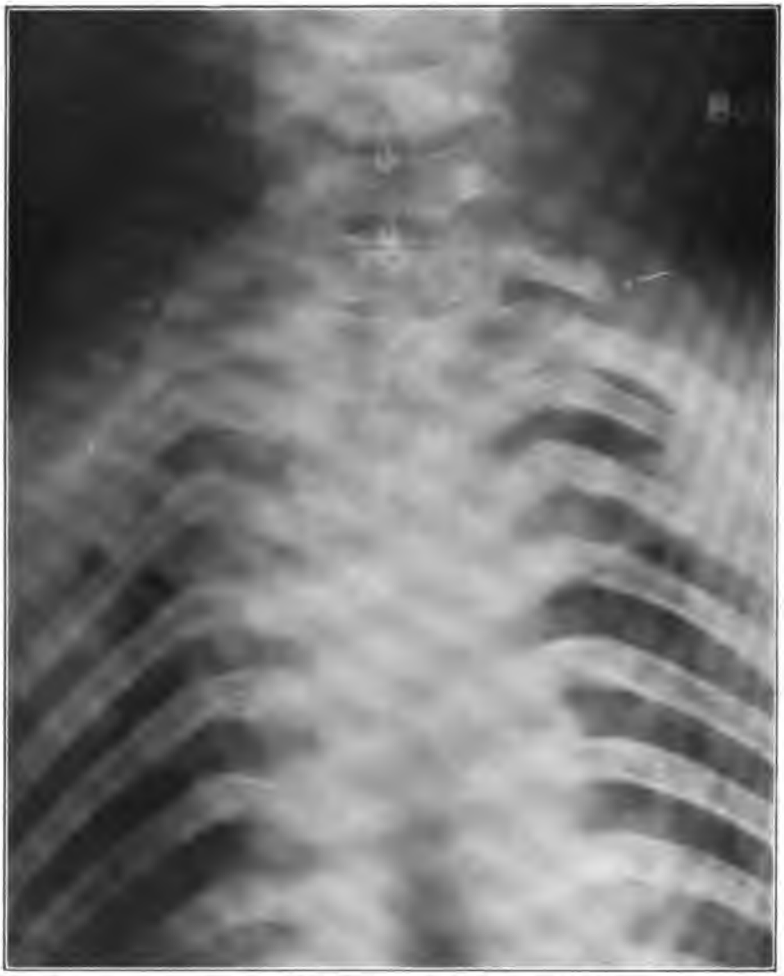

FIG. 2.

in an angle between the rib and the insertion of this muscle, which fact has been ascribed as causing the arterial symptoms of gangrene of the finger tips in the extreme cases before the true condition was diagnosed. This condition may indicate amputation, as recorded by Krabbe. Wingate Todd takes exception to the theory of gangrene due to mechanical obstruction to the blood supply. He has carefully considered the anatomy of the subclavian artery and concludes that the constriction of the vessel at this situation is normal as it is the top of the normal curve of the vessel. He states that this narrowing of the lumen of a vein to carry fluid at the top of a curve is a law of hydrodynamics. (Engineers copy this in

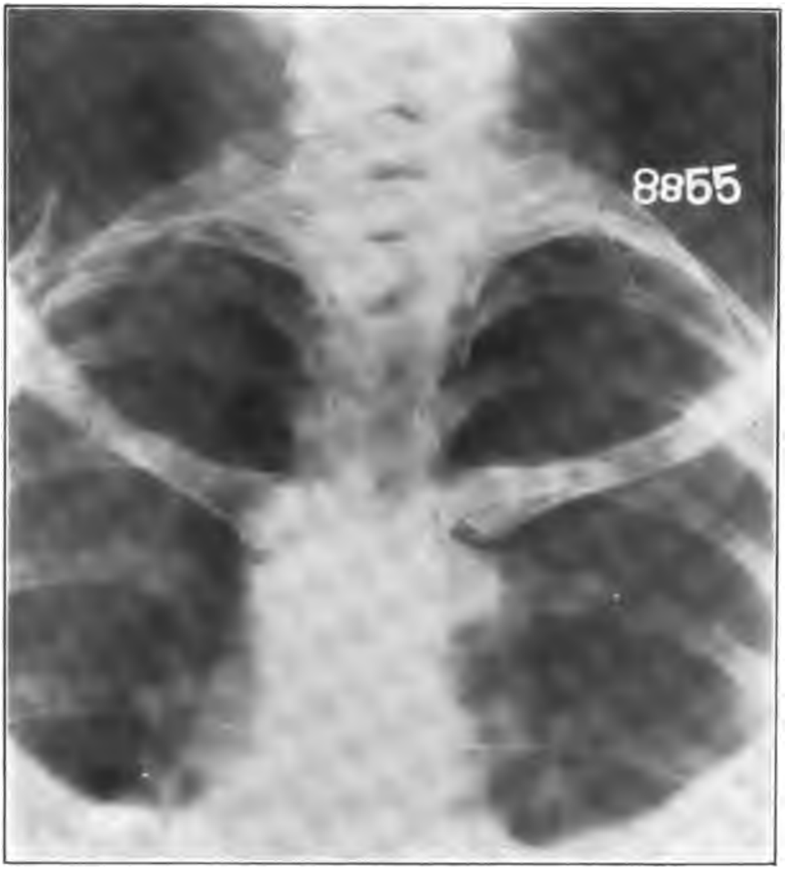

FIG. 3.

their constructive work of this nature.) He believes that the clinical and anatomic evidence is sufficient to show that pressure on the sympathetic so disturbs the nerve supply to the vessels themselves as to decrease the blood supply and cause gangrene.

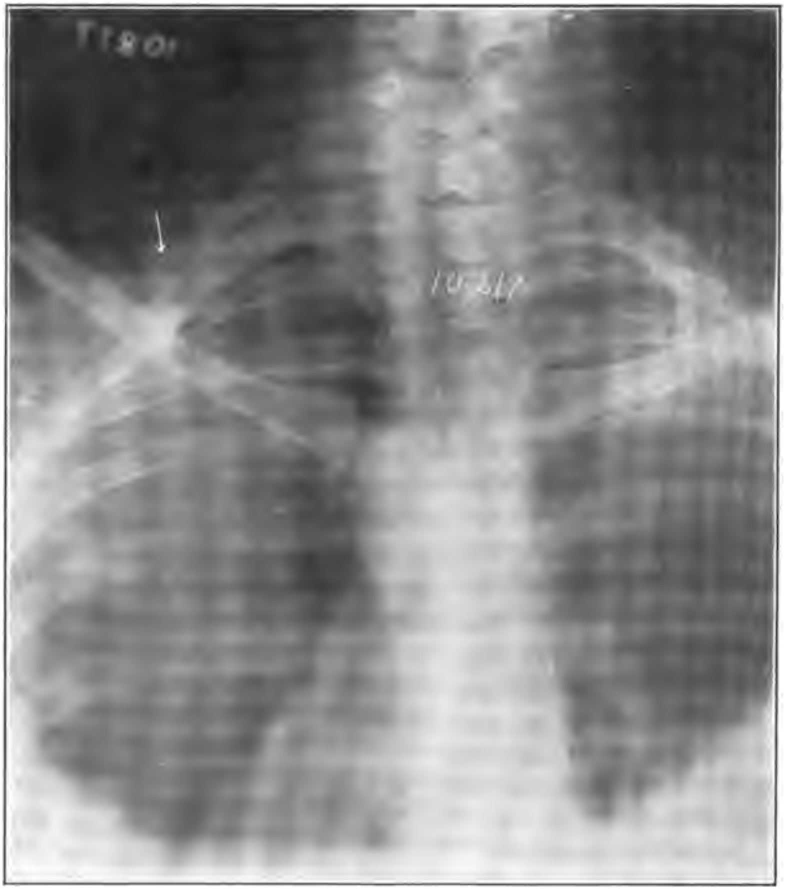

Fig. 4.

If the constriction be normal at this point it would explain the increased caliber distal to this area, as has been noted by Murphy, Keen, and Ehrlich. We do know that pressure on the vein is rarely evidenced, since edema does not often occur. The vein passes in front of the scalenus anticus and so escapes the dangerous position accorded to the artery. Gangrene and nerve manifestations are said to be more common than edema. In our series there was no case of gangrene.

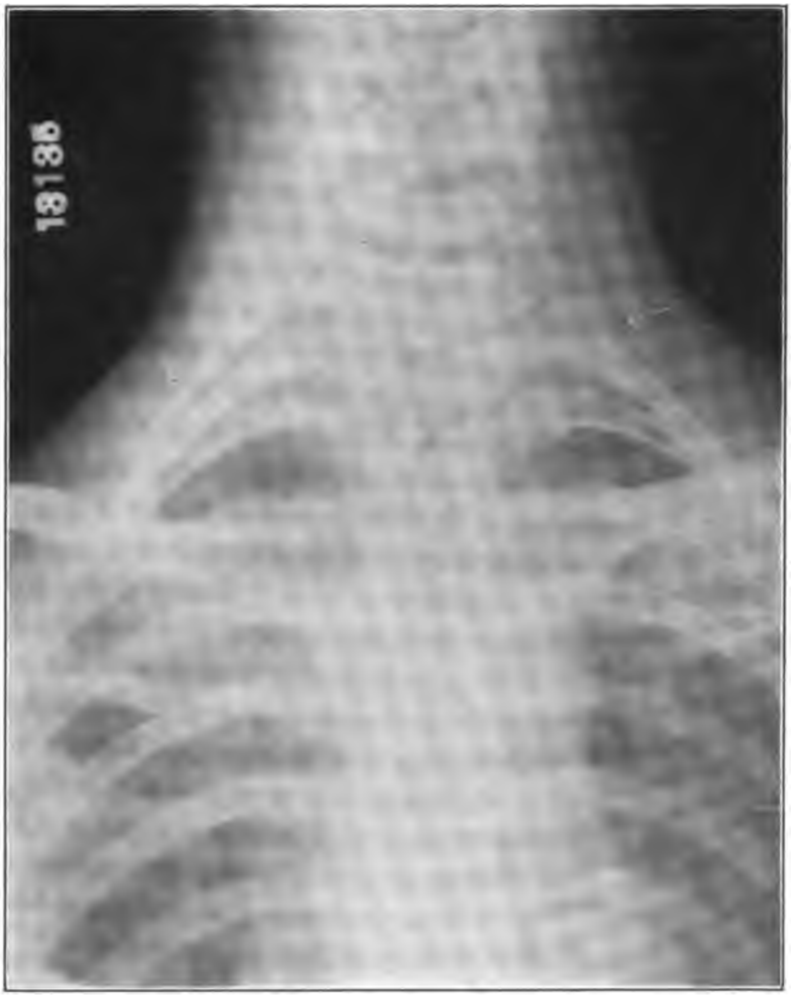

FIG. 5.

The brachial plexus is usually involved to some extent as it passes down over the rib. Naturally it is the inner cord which is implicated and this is spoken of as "the nerve of attack in cases of cervical rib." The region supplied by the nerve of Wrisberg and the ulnar are commonly affected. According to Howell the route of the first dorsal nerve passes almost

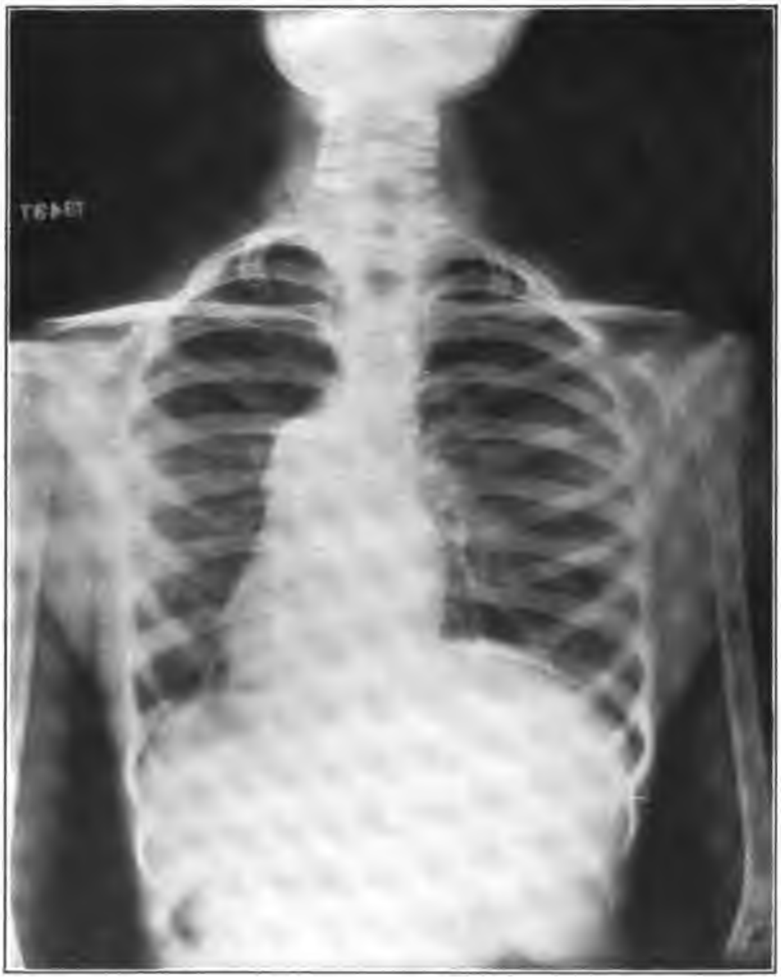

FIG. 6.

directly upward on the neck of the first dorsal rib easily coming in contact with the cervical rib as it curves downward and forward. The variety of pains occurring in the neck, shoulder and arm in different cases can all be explained by this irritation of the brachial plexus. The phrenic nerve, because of its course in the scalenus anticus muscle, is in close association

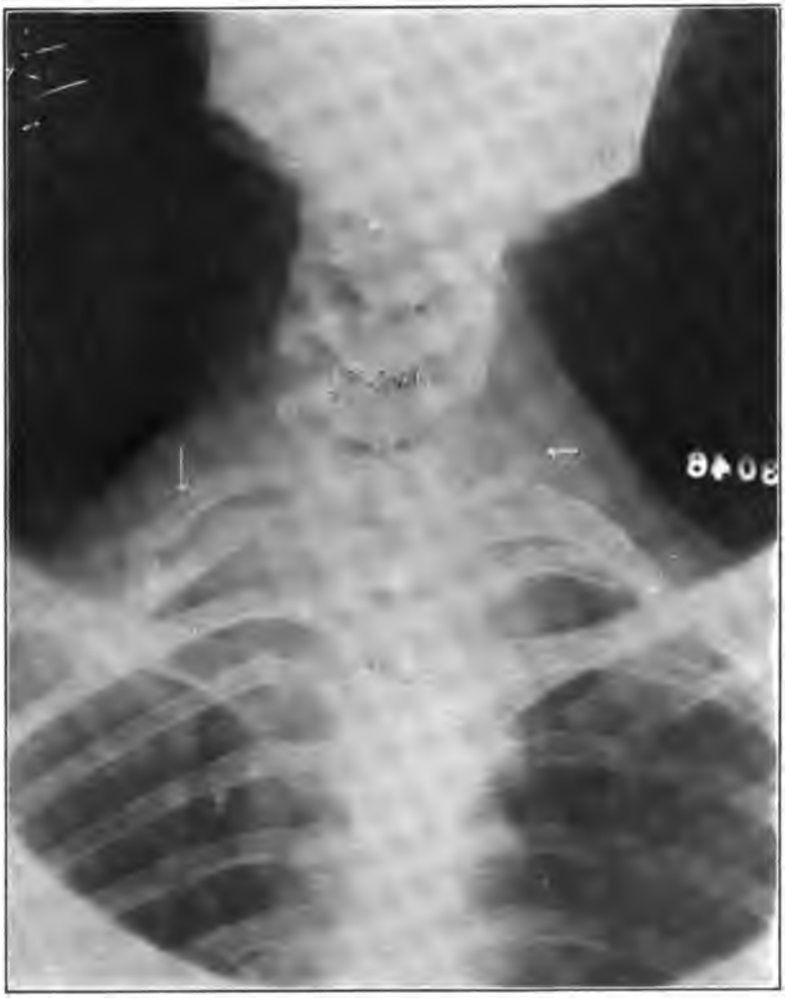

FIG. 7.

with the cervical rib. Hunt reports a case of spasm of the diaphragm which was relieved by the removal of a cervical rib.

The symptoms subjectively fall under two heads: (1) nervous; (2) vascular. Wide variations are encountered in different cases. Under the nervous phenomena may be grouped neuralgic pains moving down the arm on the side on which is the large rib, as a rule. Numbness, tingling, and formication may be encountered and there is no constancy of the

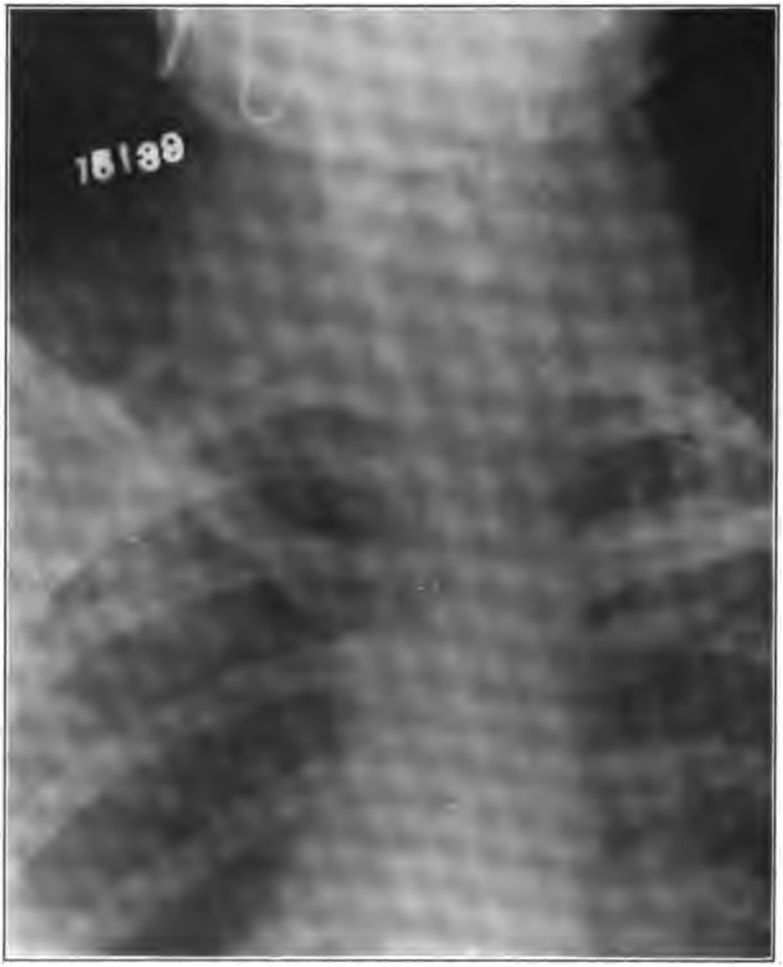

Fig. 8.

nerve involved though it is usually the ulnar or inner cord of the plexus. There may be atrophy of certain muscles, the intrinsic of the hands and of the thenar and hypothenar eminences in particular. There is frequently atrophy of the whole arm but this may be due to disuse as these patients generally restrict the use of the affected member. Loss of power in the hand-grip may be noted. Marked cases may show distinct analgesia. Ataxia has been described by some observers, but was not present in our series. Hirsch's case showed sweating on one side of the arm and dryness of the skin on the other. Certain motions of the arm may cause marked neuralgic pains down the arm. These subside on rest only to be brought about again by use. Some patients say they are relieved by raising the arms above the head and one of our patients slept in this position. Hoarseness is an occasional symptom. A girl of ten in our series had this symptom but she also had an enlargement of the left auricle. Laryngoscopic examination showed a complete paralysis of the left cord and the hoarseness was probably due to the enlargement of the auricle pressing on the recurrent laryngeal nerve as it passed up over the arch of the aorta. The pain may be all confined to the neck or pass up to the jaw and side of the face. One patient, a woman of forty-nine, had peculiar spasms of the larynx, which stopped her in the midst of a sentence, and also a sensation as though "her heart was coming up into her mouth." This occurred when she was under no emotional strain whatsoever. She had a steady pressure pain at the left side of the sternum, passing up to the left side of her neck, even to her jaw. She described a feeling of pressure over the left side of the clavical and occasional pains shooting down the left arm. There was some fullness of the left supraclavicular fossa and she complained of tenderness along the left side of the neck to the left second rib. There was also an element of neurosis to be considered. Pain was described which was irrelevant to the cervical rib. An aneurysm of the aorta had been previously diagnosed by a competent surgeon and she had been warned of its great danger. X-ray examination disclosed a left cervical rib. The rib was removed and the pain disappeared but was replaced by a burning sensation which continued for six months. The pressure pains and reflex laryngeal spasm ceased.

This case emphasizes a type of neurotic women who seem especially prone to have symptoms from cervical ribs, which is probably due to the fact that they have a hypersensitive nervous system which readily responds to the irritation of the cervical rib. Individuals with cervical ribs but with more stable nervous symptoms probably go through life oblivious of their presence. Four of the seven patients operated on were of this neurotic type.

The vascular symptoms are less prominent than the nervous but are equally as variable in intensity. There may be only slight coldness or there may be gangrene. Thrombosis has been reported extending up the arm and necessitating amputation. Pallor or erythematous patches may be present. Cyanosis may occur. Edema is rare and in one of our cases was present not as a typical edema but rather a suspicion of swelling in the hand of a woman of thirty-eight. A difference in the radial pulses is often referred to but was not present in our cases. We also took readings of the systolic blood pressure in each arm where there was any doubt, but these were the same. As regards the presence or absence of tumor or fullness in the supraclavicular fossa: in heavily muscled men there is not much to be made out. Thin people and especially women are more easily palpated and here often the prominence is detected. The tumor is usually fixed, hard and not tender. Often a distinct bruit may be heard over it and aneurysm is suggested. X-ray is the only means of definitely clearing up the diagnosis.

Technic.—There are practically two methods of attack: the posterior and the anterior. The posterior incision is preferably a "hockey stick" over the anterior border of the trapezius. Dissection is made and continued down between the posterior border of the scalenus medius and the levator anguli scapulæ. In this zone the nerve to the serratus as it passes through the scalenus medius is in danger. The advantage of this incision is that the brachial plexus comes down between the scalenus anticus and medius and is out of danger. The anterior incision is made through the posterior triangle of the neck and was the one used in all our cases. An incision is made about 3 or 4 inches in length an inch above and parallel to the clavicle posterior to the sternomastoid. Dissection is then made down on to the rib, tying as many vessels as is necessary. By adhering closely to the cervical rib injury to structure is avoided. If the rib be large the subclavian artery is on top of it; if small, the artery is in front of it. The vein is rarely seen. If the rib be large it should be taken out in pieces, but if practicable it should be removed whole.

CONCLUSIONS.

1. Cervical ribs are congenital deformities rarely causing symptoms until adolescence or later.
2. The deformity is usually bilateral (twenty-four out of thirty-one cases) and is more common in women than in men (twenty-two females and nine males).
3. The size of the cervical rib is not the index to the symptoms.
4. It is estimated that only 10 per cent. of cervical ribs cause symptoms. Out of the thirty-one cases in this report eighteen gave no subjective symptoms.
5. Brachial neuritis may be caused by cervical ribs. This neuritis may be caused by a lack of harmony (embryologically) between the first dorsal rib and the site of exit of the roots of the nerves. The roots of the nerves may have their exit low and be subjected to pressure by a normal first dorsal rib or they may have a normal position and the first rib be high. We have had one case of brachial neuritis associated with tuberculous glands of the neck when during the course of the removal of the glands the first dorsal rib was seen to be high and to impinge on the nerves. It was removed with complete relief from symptoms.
6. The theory of the difference in the site of exit of the nerve roots may explain the lack of symptoms in certain patients having well-developed cervical ribs whereas other patients with smaller cervical ribs give pronounced symptoms.

CASE REPORTS.

Group I. Cases Presenting no Subjective Symptoms.

CASE I.—A45570. X-ray 10217. J. L., female, aged twenty-seven; married. Examination Nov. 7, 1910. Operated on for double tuberculous salpingitis Nov. 15, 1910. X-ray taken to determine nature of tumor of left supraclavicular fossa showed well-developed seventh cervical rib on left; rudimentary on the right. No symptoms traceable to the cervical ribs (Fig. 4).

CASE II.—A57933. X-ray 13135. W. C., female, aged twenty-three, married. Examination Aug. 24, 1911. Dysmenorrhea. Operated on Sept. 4, 1911, for retroverted uterus. X-ray taken to determine nature of tumor in the right supraclavicular fossa disclosed well-developed cervical rib on right side and rudimentary rib on left, both seventh cervical. No symptoms (Fig. 5).

CASE III.—A66420. X-ray 15139. G. T., female, aged twenty-eight, single. Nurse. Examination April 9, 1912. Chronic mastitisof the right breast. Tumors in both supraclavicular fossæ. X-ray disclosed double well-developed seventh cervical ribs. No symptoms attributed to ribs (Fig. 8).

CASE IV.—A62125. X-ray 14120. H. C., male, aged nine. Examination Dec. 11, 1911. Condition diagnosed tuberculous meningitis. X-ray of chest for possible involvement of lungs showed double rudimentary cervical (seventh) ribs. Symptoms difficult to elicit but no connection demonstrable.

CASE V.—A58841. X-ray 13316. G. N., female, aged fourteen. Examination Sept. 13, 1911. Chronic osteomyelitis right femur and subacute periostitis left humerus. X-ray taken for possible involvement of lungs showed rudimentary left seventh cervical rib. No symptoms arising from ribs.

CASE VI.—A62307. X-ray 14138. J. M. J., male, aged thirty. Examination Dec. 15, 1911. Colloid goiter. X-ray taken for possible substernal goiter showed bilateral rudimentary seventh cervical ribs. No symptoms connected with the cervical ribs.

CASE VII.—A46957. X-ray 10536. J. T., female, aged forty-two, married. Examination Dec. 13, 1910. Goiter. X-ray showed well-developed bilateral seventh cervical ribs. No symptoms from the cervical ribs.

CASE VIII.—A68743. X-ray 15790. I. P., female, aged twenty-seven, single. Examination June 5, 1912. Abdominal symptoms attributed to adherent retroversion of the uterus and chronic appendicitis. X-ray taken to determine nature of bony prominence in the right supraclavicular fossa disclosed well-developed bilateral seventh cervical ribs. No symptoms caused by the ribs.

CASE IX.—A45473. X-ray 10197. W. R. H., female, aged fifty, married. Examination Nov. 3, 1910. Headaches. Diagnosis: migraine. X-ray taken to determine nature of tumor in right supraclavicular fossa. There was some fullness, soft expansive pulsation, booming sounds, and questionable tracheal tugging. The picture disclosed well-developed seventh cervical ribs. No definite symptom traceable to these. A letter dated Dec. 11, 1912, states that the ribs are "causing some uneasiness." Nothing further has been heard from the patient.

CASE. X.—A47490. X-ray 10647. W. J. S., female, aged 30, married. Examination Dec. 31, 1910. Indefinite neurotic symptoms. Had movable kidney of which she complained. X-ray taken to show condition of lung disclosed well-developed bilateral seventh cervical ribs. There was a little fullness in both supraclavicular fossæ. No symptoms attributable to the ribs.

CASE XI.—A30715. X-ray 5610. W. E. P., female, aged twenty-six, married. Examination Nov. 1, 1909. Tumor of the sternum, which proved at operation to be chondro-sarcoma. X-ray showed bilateral rudimentary seventh cervical ribs. No symptoms.

CASE XII.—A60436. X-ray 13649. B. H., aged twenty-three, single. Examination Nov. 23, 1911. Chronic cough and hemorrhoids. X-ray of chest for possible tuberculosis disclosed well-developed left seventh cervical rib, none on the right. No symptoms.

CASE XIII.—A69251. X-ray 15928. G. A. J., aged forty, married. Examination June 17, 1912. Diagnosis of urticaria (angioneurotic edema) and chronic constipation. X-ray of chest showed well-developed seventh cervical rib on the left. None on the right. No symptoms.

CASE XIV.—A79871. X-ray 19293. J. B. R., male, aged forty-two. Examination Feb. 11, 1913. One year previously at his home had had tumor of right cord removed which was pronounced malignant. At the time of examination in our clinic retroperitoneal involvement was evident. X-ray of chest showed well-developed left seventh cervical rib. None on right. No symptoms.

CASE XV.—A63471. X-ray 14430. W. L., male, aged twenty-nine. Examination Jan. 26, 1912. Miner: sustained injury May 15, 1911, by the caving in of a roof; was unconscious for fifteen minutes. Following this had numbness and loss of power in hands and arms. Much pain in back of neck. Had steadily improved up to date, though still some mild sensory disturbances in both hands and a little loss of power. No pain. X-ray showed bilateral rudimentary seventh cervical ribs. No lesion demonstrable in the vertebral column. The condition was thought to be due to a lesion of the spinal cord and operation was not advised for removal of the cervical ribs.

CASE XVI.—A59085. X-ray 13437. M. D., female, aged ten. Examination Sept. 25, 1911. Goiter and cardiac symptoms. X-ray taken to determine size of heart disclosed well-developed bilateral seventh cervical ribs presenting no symptoms. Paralysis of the left vocal cord was accounted for by the enlargement of the left auricle. A year later the child died of the cardiac condition (Fig. 6).

CASE XVII.—A80479. X-ray 19598. C. T., female, aged twenty-five, married. Examination Feb. 24, 1913. Operated on March 13 for dysmenorrhea. Patient also neurotic. Complained of peculiar bulging in supraclavicular fossa when coughing. No pains, numbness or tingling in arms. X-ray showed bilateral seventh cervical ribs.

CASE XVIII.—A82512. X-ray 20504. J. P., male, aged forty-five. Came for consultation on account of sinues in neck following abscess caused by lodging of a seed in his throat. X-ray taken for this condition possibly due to diseased hyoid disclosed bilateral rudimentary seventh cervical ribs. No symptoms attributable to the ribs.

Group II. Cases of Cervical Ribs giving Subjective Symptoms but not Operated On.

CASE XIX.—A56581. X-ray 12742. E. E., female, aged seventeen, single. Examination July 27, 1911. For four years had had shooting pains in right arm. Right thumb became cold and numb several times a day. Entire right hand loses feeling at the same time. Exacerbation of symptoms at time of examination. For four months had had frequent shooting pains in right leg as high as knee. Neurotic element present. Muscles of the right arm were weak and arm was smaller than left. Sensations were not disturbed. X-ray shows bilateral rudimentary seventh cervical ribs. Operation was not advised on account of neurotic element.

CASE XX.—A38537. X-ray 8855. R. F. S., female, aged thirty-two, married. Examination June 7, 1910. Pelvic trouble. Hard bony masses were felt in both supraclavicular fossæ. X-ray showed bilateral seventh cervical ribs well developed. Indefinite mild pains down the arms was complained of but not considered serious by the patient. Operation was not advised (Fig. 3).

CASE XXI.—A57685. X-ray 13046. G. L. K., female, aged forty-five, married. Examination Aug. 14, 1911. Indigestion. Complained of a little numbness in right little and ring finger. Also in right little toe and fourth toe. X-ray taken to prove the nature of tumor in right supraclavicular fossa disclosed large right seventh cervical rib and rudimentary left. Operation was not advised (Fig. 7).

CASE XXII.—A72278. X-ray 16753. H. C., male, aged forty-three. Examined Aug. 19, 1912. Symptoms for eighteen months. Boring pain flexor surface of left arm. For the past month occasionally the same pain in the right arm, worse on exertion, particularly in pitching hay. Lately increasing loss of power left arm and hand with intense pain on use. Naturally left handed, but there was 1/2 inch atrophy at the biceps. Reflex of the left biceps decreased. No numbness. X-ray showed bilateral rudimentary seventh cervical ribs. Operation was advised but the patient was lost sight of. This patient was sent in by his physician with a diagnosis of tumor of the spinal cord.

CASE XXIII.—A36137. X-ray 8320. G. W. A., female, aged sixty, married. Examination April 5, 1910. History back to when fourteen years of age when the patient had severe pain for several years in her left arm. Always some pain in left shoulder and along the neck. Some atrophy of left shoulder. About time of onset tumor was noted above left clavicle. Always some discomfort with exacerbations. Some atrophy of supraspinatus muscle and thenar eminence on left side. Handled left arm carefully. X-ray showed well-developed left seventh cervical rib. None on the right side. Operation was not elected on account of the age and disinclination of the patient, who did not consider the symptoms serious enough for operation.

CASE XIV.—A80360. X-ray 10529. V. H., female, aged twenty-four, single. Examination Feb. 20, 1913. Complained of pains in hands and arms after using them. Hard work at stenography for four years. Was well until the summer of 1912, when she began having shooting pains in hands and wrists spreading up the arms. Forced to discontinue work for a week. Improved with rest; on resuming work the pains recurred and she has not worked since December. Physical examination negative. X-ray showed bilateral rudimentary seventh cervical ribs. Operation advised but deferred up to date.

Group III. Cases operated on—One Palliative, Six Radical.

CASE XXV.—A12860. X-ray 2765. J. L. N., female, aged forty, married. Examination July 28, 1908. Patient complained of a fixed bony mass in the right supraclavicular fossa. She had known of this mass since childhood, but of late years it had grown steadily; more rapidly within the last six months. Since the patient had been operated on eight years previously elsewhere, having ovaries, tubes and uterus removed supposedly for cancer, she was alarmed. On operation Aug. 3, 1908, a good-sized right-sided seventh cervical rib was removed. The patient has not been heard from since being discharged.

CASE XXVI.—A31940. X-ray 5800. W. P., male, aged five. Brought by parents on account of hard elongated tumor in right supraclavicular fossa. Examination Dec. 8, 1909. The child had no subjective symptoms but the parents wished the tumor removed. Measurement of the arms the same. Dec. 18, a fully developed right cervical rib which articulated behind with the seventh cervical vertebra and in front with the first rib was removed. It was taken out in pieces. The pleura was opened with no bad effect. X-ray did not reveal cervical rib on the left side. Recovery was uneventful. The patient has not been heard from since he was discharged.

CASE XXVII.—A35026. X-ray 8086. W. R. J., female, aged twenty-nine, married. Had been examined in the Mayo Clinic four years previously. Cervical rib left side was diagnosed and operation advised, but was deferred. Symptoms now the same though aggravated. Lump in left side of neck growing larger; pain up left side of neck and head to eye. Pain down to left shoulder. Arm swells at times. Collars seem too tight. Fullness in both supraclavicular fossæ especially on the left. Here a thrill and bruit were discovered. X-ray disclosed double well-developed cervical ribs. March 10, 1910, the left cervical rib was removed. The right was not removed as it was giving no symptoms. The patient's recovery was uneventful. She has not been heard from since one month after operation (Fig. 2).

CASE XXVIII.—A41366. X-ray 19769. L. M., female, aged thirty, married. First came for examination Aug. 6,

1910. Her symptoms indicated neurosis and a diagnosis of such was made. She returned March 4, 1913. During the interval her symptoms had become aggravated, particularly pain in the right arm moving up to the chest. Most of the pain, which was dull and persistent, extended up the dorsal surface of the right forearm and the inner surface of the arm. X-ray disclosed bilateral rudimentary seventh cervical ribs. March 10, 1913, a rib 3/4 inch long projecting into the muscles and over which the middle trunk of the brachial plexus was resting was removed. The patient's recovery was uneventful.

Case XXIX.—A44245. X-ray 9949. H. R. F., female, aged forty-nine, married. Came for examination Oct. 6, 1910. Hysterectomy had been done three years before for gradually increasing dysmenorrhea. Patient had improved greatly in health following this operation. Her symptoms at time of examination in our clinic were of eighteen months' duration. She had an irritating cough and pain in the chest. At first a burning sensation in central lower sternum which was practically constant and was worse on movement. Within the last six months the pain had changed somewhat to a "pressure pain" passing up left side of the neck to a point just beneath the angle of the jaw—sensation of pressure against the neck on the left side. A spasm of the muscle of the throat stopped her in the midst of a sentence; occasionally a feeling as though something were rising up in her throat as when frightened or excited and this when entirely free from any emotion. Loss of 29 pounds during the past year. Occasionally had pains shooting down left arm. Physical examination disclosed a little fullness of the left supraclavicular fossa and a bruit which had led to a diagnosis of aneurysm being made elsewhere. There was some tenderness over this area. Patient neurotic. Dec. 10, 1910, a fully developed seventh cervical rib was removed. X-ray did not reveal cervical rib on the right side. There was no sign of aneurysm. This patient had a stormy convalescence following operation. A persistent neuritis down the arm existed for months and is still present to a degree. The cough ceased, the throat spasms disappeared and she gained more than her normal weight, but is still neurotic.

Case XXX.—A49237. X-ray 11010. J. H. G., male, aged thirty-nine. Examination Feb. 13, 1911. Complained of slight pain on right side of neck becoming sharp at times on turning head which stretched the muscles on this side. X-ray plate showed bilateral rudimentary seventh cervical ribs. Excision was not advised but on Feb. 16, 1911, the right side of his neck was subjected to actual cautery and superficial injections of alcohol. He felt sufficiently relieved not to return for excision.

Case XXXI.—A71669. X-ray 16589. C. Y., female, aged twenty-one, single. Examination Aug. 6, 1912. Seven years before had noted hard lump on right side of neck. The condition had been diagnosticated at that time as a cervical rib, but surgery was not advised, unless symptoms should arise. The patient was nervous and neurotic. Pains down both arms, ache like a toothache over this lump, worse when tired. X-ray showed bilateral seventh cervical ribs rudimentary on the left, complete on the right. Operation Aug. 8, 1912; a complete right seventh cervical rib was removed. Her recovery was uneventful.

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XXXIII.

JOINT SYPHILIS.

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Syphilitic arthritis was described as early as 1488 by Petrus Martyr. The condition was also referred to by Alphonsus Ferrus, in 1537, and by Morgagni and Fabre in the seventeenth century. Although Hunter did not think that syphilitic arthritis occurred, he was opposed by others of his time. Richet, in 1853, was the first to give a clear account of the disease. Since that time the condition has been recognized, and has been described by a number of authors. In spite of the fact, however, that syphilitic arthritis has been recognized for a long while, and that the literature on the subject is quite voluminous at present, yet the knowledge of the condition seems to be rather indefinite. Most of the articles deal only with a few interesting cases, or describe only one or two of the various forms in which the disease appears. The French, German and English have written much on the subject, but in America, authors have disregarded the subject almost entirely. This attitude is also reflected in the leading American text-books, where the subject is either dismissed with a word or two, or has only one or two pages devoted to it.

There is a marked difference of opinion as to the frequency of the disease. Kaufmann says it is rather rare, and this opinion is also held by Ribbert. Bradford and Lovett, and Taylor are also inclined to this opinion. On the other hand, a great many writers on the subject believe that the disease is much more common than is supposed, and that it is frequently mistaken for other joint conditions, notably arthritis deformans, and the various tubercular affections; also that it is an important factor in the production of suppurative bone and joint conditions of childhood (Gaucher, Levy-Bing, Stewart, Grant, Winfield, Bering, Frauenthal, Goldthwaite and Osgood) and is often confused with malignant and other diseases. Levin believes that hereditary and acquired joint syphilis are more common than they were formerly thought to be. Ziesche also thinks that syphilitic spondylitis is much more common than supposed and reports the details of eighty-six cases. Fournier claims that 39 per cent. of all congenital syphilitics have arthritis and von Hippel 52 per cent., while Schüller says that 7 per cent. of all joint diseases in children are syphilitic. Patton, Hunkin and Harker believe that syphilitic arthritis is more common than was suspected.* It will be seen that the weight of opinion is in favor of this belief, and that it is probably frequently mistaken for osteoarthritis, tuberculosis of the joints and other conditions.

Most of the literature antedates the discovery of the Wassermann reaction, so that up to the present time this aid to diagnosis has not been extensively used to verify the truth of the above statements. All the writers agree that hereditary syphilitic joint lesions are more frequent than the acquired form.

I believe that syphilis of the joints is much more common than has been supposed and that it plays an important rôle in joint affections. As the subject has been infrequently dealt with in America, I have endeavored to collect the literature on the subject, to review the various opinions expressed, and to present a picture of the various forms assumed by syphilitic arthritis. A series of cases of joint syphilis with comments will be presented and a bibliography, as complete as possible, appended.

In this paper, syphilis of the bones has not been considered, as those lesions are well known, and their symptoms, pathology and treatment have been carefully described; nor has any reference to Charcot joints and similar conditions been made.

The classification of the various types of joint lesions caused by syphilis is fairly uniform, and is based mainly on the work of

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* Since this paper was written, Baets reports that of 100 cases of acute arthritis seen in negro workers on the Panama Canal, sixty-three had syphilitic arthritis (*Journal A. M. A.*, April 5, 1913).

Virchow. A number of forms, however, has been reported, which does not conform to this classification; Wysocki does not believe that there is a typical picture in joint syphilis.

The articular symptoms must be divided into those of congenital and acquired syphilis. In acquired syphilis the symptoms may be classed under (1) early secondary, (2) secondary, and (3) tertiary stages.

(1) In the early stage of acquired syphilis, Patton speaks of an arthralgia, of which it is doubtful, whether it is a joint affection, or a periarticular condition. It occurs early, sometimes before the rash appears. The pain may be intense, in and around the joint, and is often worse at night. It is not increased by movement, and the range of motion is not impaired, or is only slightly limited. There may be a little stiffness in the morning. Several joints may be affected at the same time. Waterhouse speaks of these symptoms as similar to those of eruptive fevers, and says that they may precede the eruption by a couple of weeks. There may be a swelling of the synovia or neuralgic pains, which may be affected by the weather. Levin and others describe the same condition.

(2) During the secondary stage a very common form is an acute or chronic synovitis. In many cases it comes on without any warning, usually accompanied by some pain and tenderness, which is not increased by motion, and may be unaccompanied by any other signs or symptoms. There is no constitutional disturbance, but in some cases it may be preceded by some malaise. The condition may closely simulate rheumatic fever (Patton, Frauenthal and Voss). Vaffier has described it as syphilitic rheumatism. There is, however, no cardiac trouble, nor acid sweats. Several joints may be affected at the same time. Wysocki believes that there may be a high prolonged fever in syphilitic joint involvement simulating rheumatism. Levin and Goldthwaite believe that the condition may resemble gonorrheal rheumatism. Whitman says that the knees, shoulder, elbow and sternoclavicular joints are most often involved.

Hydrarthrosis is a symptom appearing during the secondary stage. Hydrops may be the only clinical symptom and may occur in the beginning of the secondary stage, or a year or more after infection (Morestin). Its onset is slow and insidious, usually without pain. The knee is most often affected. It may succeed the more acute or synovial effusion (Patton). Bering says the onset may be acute.

(3) In tertiary syphilis, according to Bradford and Lovett, a chronic serous synovitis may be present.

Gummatous osteitis is a cause of secondary affections of the joints when situated in their neighborhood. These conditions in which the disease is primarily in the bone or cartilage, result in much more damage to the joint. The pain is much less than in similar tuberculous conditions.

Subacute or chronic synovitis is also met with in tertiary syphilis. The knee is most often affected, as is the case with all joint involvement in this stage. There is little pain or interference with motion. This, according to Patton, is almost a diagnostic point. There is usually a little thickening of the synovial membrane, and a little creaking. The amount of fluid present may vary. Occasionally there is a slight rise in temperature. According to Waterhouse a chronic synovitis is met with, similar to rheumatoid arthritis, which may occur without any other active symptoms, and may appear a number of years after the initial lesion.

Patton mentions a gummatous synovitis, which he says may resemble a subacute synovitis, but in which, subsequently, a gummatous mass may be felt. There may be no fluid, but a very irregular lumpy thickening of the synovia. The amount of pain varies, and is frequently greater at night. Motion may cause little pain, and there may be very little limitation of motion. There is no starting pain. Remissions and almost complete cure with relapse are very characteristic of this condition. Frauenthal believes that it may be mistaken for tuberculosis. If the disease has spread to the surrounding parts, there may be an infection of the joint as a result of an adjacent gumma breaking into the joint and then opening to the surface (Patton, Frauenthal). Waterhouse describes a condition, which is very characteristic, in which the surface of the inflamed joint is covered by circular and serpiginous ulcers, especially when met with in women rather past middle age. Levin says that perisynovitis, gummosa and chondroarthritis are destructive and impair function. Wiggs describes a gummatous perisynovial hyperplasia, which may terminate in an osteitis of the degenerative type and occasion considerable destruction of tissue and loss of function.

Morestin describes a form of arthritis in which the bone changes are most marked. In this there are marked hyperostoses, whose development may be rapid. Pain, if present, is more marked at night. This type may produce ankylosis or great relaxation. Richet and Pollak report cases of intermittent hydrops, as a result of syphilis.

The tertiary stage of syphilis, according to a number of writers, seems to be responsible for certain osteoarthritic changes. Virchow and Fournier describe a deforming type which resembles the lesions of arthritis deformans. Ely reports a case of rheumatoid arthritis, probably as a result of syphilis. Patton says the joint conditions in tertiary syphilis may be mistaken for osteoarthritis. Waterhouse believes that in joints which have been the seat of syphilitic disease, as in other damaged joints, a condition of osteoarthritis may supervene. It is doubtful, however, whether syphilis is ever responsible for multiarticular rheumatoid arthritis (Wollenberg). Syphilis is recognized as a predisposing cause, and chronic tertiary arthritis of syphilis can simulate arthritis deformans. Heckmann is of the opinion that monarticular arthritis deformans is usually caused by a trauma, but that there is a syphilitic base. The resulting synovitis from injury, does not heal promptly on account of syphilis, but runs into typical proliferative arthritis deformans. Heckmann excepts the senile form. Stühmer got a strong Wassermann reaction in a series of polyarticular arthritis deformans, and believes that in these cases syphilis was of importance as an etiological factor. Virchow, Geis, Bowlby, and Jonathan Hutchinson have reported cases, tending to show that active syphilis may cause a condition similar to osteoarthritis. Hunkin and Harker report a case of painful feet, as a result of syphilis.

Ziesche reports a case of his own and reviews fifty-three other cases of syphilitic spondylitis. The condition is usually considered malignant, but in his opinion this supposition is made because the cases are not recognized until too late. He also believes that it is much more common than is supposed. In mild cases, the lesion heals and nothing is known about it.

The types of hereditary syphilis are better known and more generally understood. The joints are probably more frequently attacked in this condition than in acquired syphilis.

One of the most common forms is a simple symmetrical synovial effusion (Patton, Frauenthal) found in children between eight and fifteen. The joint most frequently affected is the knee. There is practically no pain and little interference with functions. The amount of fluid may be considerable, but there is no other change in the joint. Tubby says the condition is secondary to involvement of bones in the neighborhood.

According to Bradford and Lovett the most common form of hereditary syphilis is the osteochondritis of Parrot; as a result of bone involvement a secondary synovitis occurs which may be purulent in character. The clinical signs are thickening of the bone at the epiphyseal line, tenderness and joint inflammation, secondarily with lameness and even uselessness of the limb for a time. Several joints may be involved. The condition occurs early in infancy. In the milder cases there is a simple sympathetic synovitis; in the advanced cases, a destructive arthritis (Whitman).

Kirmisson and Jacobson describe a single osteoarthropathy, which is commonest in large joints. It begins insidiously with severe and persistent nocturnal bone pain. One of the long extremities enlarges and the condition simulates tumor albus. Limitation of motion is mechanical only.

Patton describes a primary gummatous affection of the synovial membrane, which is the same as the condition seen in acquired syphilis. This is similar to Frauenthal's gummatous synovitis. In deforming osteoarthropathy (Kirmisson and

Jacobson) an epiphysis may become irregularly enlarged and greatly changed in shape, with resulting marked limitation of mobility. There may be even partial ankyloses due to alteration in bone ends (Fournier). The condition is sometimes mistaken for dislocation. The shoulder, elbow and knee are most affected (Tubby). Pain is absent or very slight. Wiggs claims that the small joints are most frequently involved. In this he differs from most of the other observers.

In children of about fourteen there may develop a chondroarthritis (Tubby). The chief feature of this type is a recurring synovitis with chronic inflammation of neighboring bone. This form is said not to respond to treatment and is practically incurable. It may be described as a parasyphilitic condition.

It will be seen that the types of hereditary syphilitic arthritis are less distinct than those of the acquired form, and that one type seems to run into the other.

Bering believes that many cases appear in acquired syphilis which can be classed neither in the early, nor in the late stage. Wysocki does not believe that there is a typical picture in syphilis of the joints.

Comparatively little is known of the pathologic conditions present in the arthritis of secondary syphilis, due to the fact that autopsies have not been secured (Patton); in general, the lesions of this stage consist mainly of synovitis and tend to heal without impairment of function. Those of the tertiary period, on the other hand, lead to more extensive involvement of the joint and may cause marked destruction.

The athralgias are similar to those of other infectious diseases (Waterhouse) and are probably toxic. In the later secondary stages the pathological changes are probably the same, but varying in degree with the intensity of the symptoms. There is usually some moderate thickening of the synovial membrane. The amount of fluid may vary from a very small quantity to a large amount. Patton, Waterhouse, Virchow, Borchard and Kaufmann and others.

The lesions of tertiary or late syphilis are much more extensive and the morbid anatomy is much better known. The most common are those in which the synovial membrane is involved, are usually monarticular, and are most commonly found in the knee (Morestin). There is a marked effusion. Flattened bodies are found at the points of ligamentous attachments, which are somewhat movable, and resemble foreign bodies (Goldthwaite, Osgood and Painter). These are gummata, and may progress to ulceration, and open into the joint. The bony ends are usually intact or show only slight hyperostoses (Kaufmann).

At times the gummatous mass so completely fills the joint, as to resemble tuberculosis. The process begins in the synovial membrane and extends to the bone (Virchow, Brochin, Davis, Colly, Richet). If the process progresses too far, extensive damage may result. This is much greater when the process starts in the cartilage or bone. When the lesion is in the bone it is in the form of a gummatous deposit with syphilitic osteitis and enlargement of the bone. As it progresses it may open into the joints through the cartilage. When the process starts in the cartilage it has been described as chondritis syphilitica (Virchow). In this condition there is a loss of cartilage, accompanied by fibrous scarring. This destruction does not appear at the points of greatest pressure as is the case in osteoarthritis, but frequently it is to be seen as a circular pit-like depression. If a fibrous change has occurred fibrillation is not present, but stellate scars, which are characteristic (Kaufmann, Virchow, Frauenthal, Levin, Brodie, Bumstead, Ribbert).

Bradford says, "Gummatous osteitis is a cause of secondary affections of the joints, when situated in their neighborhood. On section, the bone shows, most often in the periphery, a yellowish-gray focus of disease, in appearance strikingly like the early stage of focal tuberculosis. But from this latter it may be distinguished by the absence of any surrounding hyperemia or infiltration, which goes with tuberculous disease."

In *hereditary syphilis* the most common form is osteochondritis (Bradford and Lovett). It is usually a single osteoarthropathy (Kermisson and Jacobson) commonest in large joints. One of the bony extremities enlarges and the condition is similar to tumor-albus. There may be hyperostoses at some distance from the joint. Limitation of motion is mechanical only (Goldthwaite, Painter and Osgood). This leads to separation of the epiphysis and the rupture into joints (Kaufmann).

Tubby says that syphilis of the joints in the congenital form is secondary to bone syphilis in their neighborhood. An early form is a simple serous hydrarthrosis. In other cases the involvement may be so great as to invade the joint by direct continuity or by eruption of pus into joint cavity. "In osteochondrosis (Whitman) there is a multiplication and an irregularity of the cartilage cells of the ossifying layer and premature calsification. Necrosis may result, as shown by a zone of hard, dry, yellow substance in the ossifying layer of the cartilage, about which newly formed bone is softened and in part replaced by granulative tissue. If the disease is progressive, ulceration and suppuration may follow; the cartilages may be destroyed and the epiphysis may be separated, causing deformity and cessation of growth. The neighboring joint is usually involved in the disease. In the milder cases there is a simple sympathetic synovitis; in the advanced cases a destructive arthritis."

In the joint condition associated with epiphysitis, Patton is not certain whether the joint is affected, but says it seems to be filled with a soft fungating substance.

Hydrops is an important type of this stage. The synovia is thickened locally and diffusely. Change is not evident on examination (Kirmisson, Jacobson, Batton, Tubby, Kaufmann and others).

There are two forms of gummatous joint involvement (Kermisson, Jacobson, Goldthwaite, etc.) one synovial or capsular, spreading into the articulation, causing villi which may contain gumma (Kaufmann); the other is primarily osteal, extending into the joint, causing extremely destructive changes in the bone and cartilage and in some cases resulting in suppuration and ankylosis.

Fournier, Patton, Frauenthal and others describe a condition which occasionally occurs, in which the epiphysis becomes deformed in an irregular manner by osteophytic outgrowths. There results marked deformity in the joint, and much limitation of motion or even partial ankylosis, due to an alteration in the bone ends. There may be muscular and ligamentous contractions (Tubby).

In older children about fourteen a rarefying osteitis, associated with a deposit of caseous material in the cancellous tissue affects many bones. The process extends to the articular cartilage, causing a grooving and pitting, the condition being known as chondroarthritis. This form is said to be resistant to treatment, and practically incurable.

There are as many different symptoms in syphilitic arthritis, as there are types. The predominating feature seems to be absence of pain. Even in cases in which there is a very marked involvement of the joint, pain is, as a rule, absent or only very slight, and in the early stages and before destruction has taken place, is not increased by motion. Pain when present, is very apt to be worse at night, but may, however, be very severe and persistent without this nocturnal exacerbation. The onset is as a rule gradual.

In the secondary and early hereditary stages the important symptom is a simple synovitis, with varying amounts of effusion. In the tertiary stage gummatous conditions are present with effusion or gummatous thickening in the joint. In the early secondary stage there may be a moderate increase of temperature, or even at times, a high fever.

It will be seen from these more or less contradictory symptoms, and from the various types described that the diagnosis is not easy. A previous history of syphilis, or some of the sequelæ may help in the diagnosis. These, however, are not always to be obtained. In such cases, the diagnosis must be made on the signs. Levin says, "When joint disease is the only manifestation of syphilis, and there are no other symptoms, the nocturnal exacerbation of the pain is in itself a sufficient indication of the actiology. But, even in the absence of this pain, in every case of chronic hydrarthrosis of unknown origin that does not respond to the usual treatment syphilis ought to be considered."

Since the introduction of the Wassermann reaction, however, the diagnosis has been much simplified. Ten out of eleven of Bering's cases, gave a positive Wassermann. The diagnosis, according to Wysocki, is to be made on the Wassermann reaction.

The important lesion with which syphilitic arthritis is apt to be confused is tuberculosis of the joints. Grant says many cases diagnosed as hip-joint disease and Pott's disease are due to hereditary syphilis. The diagnosis is made on the fact that the pain in syphilis is less severe. Gonorrheal arthritis and rheumatoid arthritis may be confused with syphilitic arthritis, but here also the Wassermann is an aid. There are some conditions in late syphilis, where considerable destruction has taken place, which are easily confused with arthritis deformans. In these, an accurate diagnosis cannot be made.

The acute syphilitic arthritis in the secondary stage may be mistaken for acute articular rheumatism, but here the fever, as a rule, is less high; there are no acid sweats and there is no cardiac involvement. Here again the Wassermann and therapeutic tests are of value.

All the authors agree on the treatment. In all cases diagnosed as syphilitic arthritis specific treatment should be used and preferably the mixed treatment in some form. Local treatment according to Patton and others, is unnecessary except in pain, in which case the joint should be at rest. "In general the treatment of the joint affection would be included in the treatment of the disease of which it is a complication. If the joint is involved in a destructive process, apparatus to insure rest and protection is indicated. The removal of irritative disease in the neighborhood of a joint is sometimes possible in older subjects, and in this class of cases an exploratory incision for inspection of the joint is sometimes advisable" (Whitman). This view is also held by Powers and Hartung.

The prognosis depends upon the accuracy of diagnosis and faithfulness of treatment. If taken in time and treated by general specific treatment, with surgical measures as indicated, complete restitution will be insured. Even if there is much destruction or a scar formation specific treatment arrests the process, and saves what is still reparable (Hartung). If untreated, serious disability is apt to result (Bering).

Briefly, then, a review of the literature shows that syphilis of the joints is a disease much more common than supposed, and that many diseases, diagnosed heretofore as tuberculous arthritis, rheumatism or osteoarthritis, are really syphilitic. The types are, on the whole, very varied, simulating almost every form of arthritis. In acquired syphilis, however, there is arthralgia in the early secondaries, followed by synovitis with effusion or hydrarthroses. These types usually show little or no joint change, and only a slight capsular thickening. In the tertiary stage there is a synovitis, secondary to a bone involvement or a gummatous involvement of the synovial membrane, filling the joint cavity and extending to the adjacent bones. This may be primary either in the bone or capsule. In this form, the destruction is apt to be considerable.

Pain, as a rule, is absent or slight and is generally worse at night. Motion is usually not painful unless there be destruction. There are no heart lesions, and fever is only present in the early secondary stage and as a rule is not very high.

The diagnosis is made on the symptoms and signs of previous syphilis; but mainly on the Wassermann test. Joint tuberculosis is the important condition with which syphilitic arthritis is apt to be confused. It must also be differentiated from rheumatism, gonorrheal arthritis and osteoarthritis.

The treatment is a general specific one with rest and protection for the joint when destruction is taking place. The prognosis is good if the diagnosis is made early and the treatment pushed.

I was impressed by the number of cases diagnosed as syphilitic arthritis at the orthopedic clinic of the Washington University Hospital.

As a result, I came to the conclusion that syphilis of joints was either more common than was supposed or that the diagnosis was erroneously made. In order to verify one or the other of these suppositions, I began this investigation.

A careful history was taken of every case of arthritis that came to the clinic and especial care was given to the slightest suggestion of syphilis, and when it was impossible to make a positive diagnosis of some other form of arthritis a Wassermann was made. This was also done in a number of cases in which there was no venereal history to be obtained. X-ray pictures of all arthritic conditions were taken as a routine. From these patients, the author selected, for special study those, who promised to attend the clinic regularly, so that the case could be followed.

A full and detailed history was taken and the subsequent course of the arthritis, and the effect of treatment noted. The author wishes to present twenty-six of these selected cases, which have been studied since October 1, 1912.

The histories of those cases which were referred to the hospital for operation and treatment, are also presented. No attempt has been made to group the cases, but they are presented in the order in which they came to the clinic.

The first case is reported in full, showing the routine examination. The history and examination were written on a form sheet, and, in all cases reported the same routine examination was made. For the sake of brevity, however, the other histories will be condensed, giving the most essential features only. Examination findings of a normal viscera, reflexes, etc., will be omitted.

CASE I.—I. B., aged forty-five, female, colored, married, housework. For last two years cook at restaurant, night work. First seen Aug. 3, 1911.

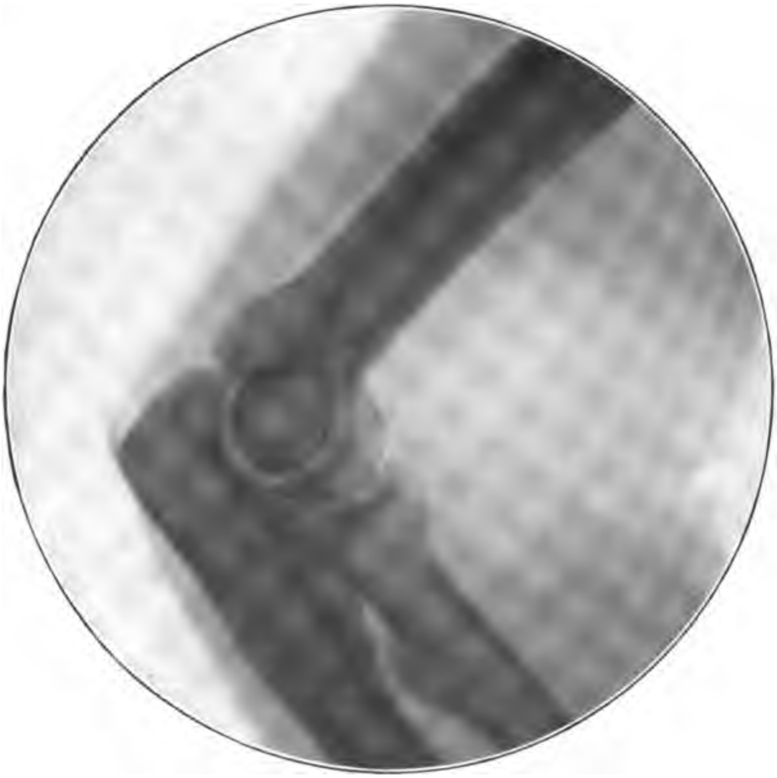
Diagnosis.—Specific periostitis.

Habits.—Drinks two or three cups of coffee a day, drinks five cent can of beer and two or three drinks of whiskey a day.

Mode of Life (*Food*, *Sleep*, *Exercise*, *Etc.*).—Eats meals regularly and slowly, masticates well. Sleep very restless, but stays in bed about seven hours.

Family History.—Husband living and well, one boy living and well. No children dead, no miscarriages. No history of acute rheumatism, chronic rheumatism, obesity, diabetes, heart disease, lung disease, renal diseases, apoplexy, gout, skin or other diseases in patient's family.

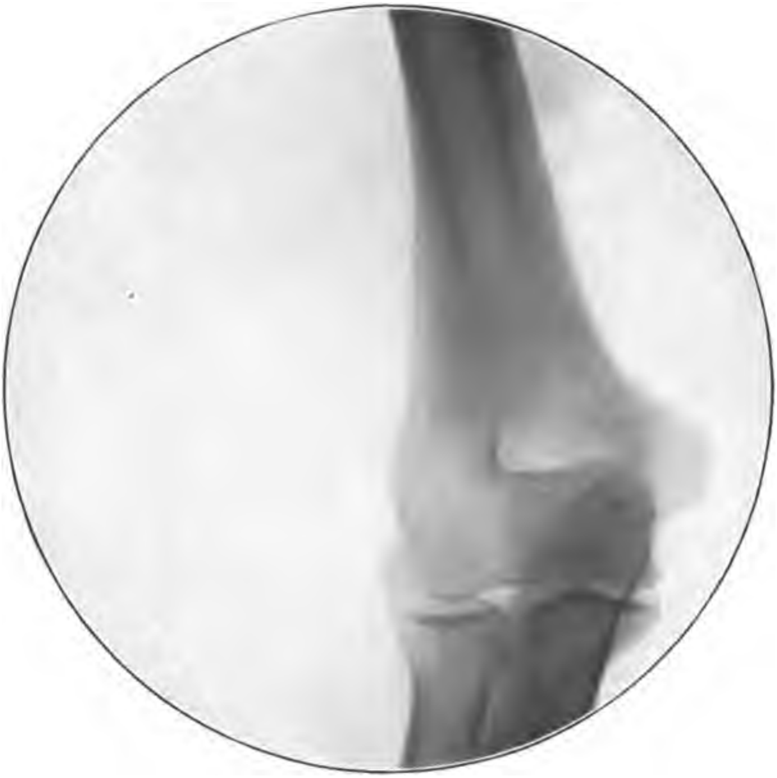
Previous History.—(A) No articular diseases. (B) Diphtheria thirty six years ago. (C) Menstruated at fifteen years of age. Always comes twice a month and regularly, no pain, scant, clots, menopause two years ago. "Whites" one year ago. Diseases of (1) throat—subject to tonsilitis; (2) no circulatory trouble; (3) no respiratory trouble; (4) no gastro-intestinal; (5) no genito-urinary condition; (6) very nervous and irritable, especially at night. (E) Gout, obesity, diabetes, none. (F) Psoriasis and other skin disease, none. (G) Past and present occupations: Joints most used, exposure, trauma. Past occupation, housework. Present occupation, cook for last two years at night. Arms and legs not exposed. About four years ago fell out of window, and fell on knees. Right knee became sore and is so at present.



CASE I.

Condition of Past and Present Dwellings.—(Situation, warmth, soil, moisture, sunshine.) Past and present dwellings fair, situation good, warm, no dampness. Plenty of sunshine and fresh air.

Present Illness.—Duration two years, pain at first in right foot. One week later pains noticed in back and hips. Pain is of a continued aching character. While these pains continued face and eyes began to swell, and became painful, at present pains all over body. Patient is "nervous," does not sleep well, but pains are worse while resting. Teeth, not loose, but gums feel dead, no falling of hair.

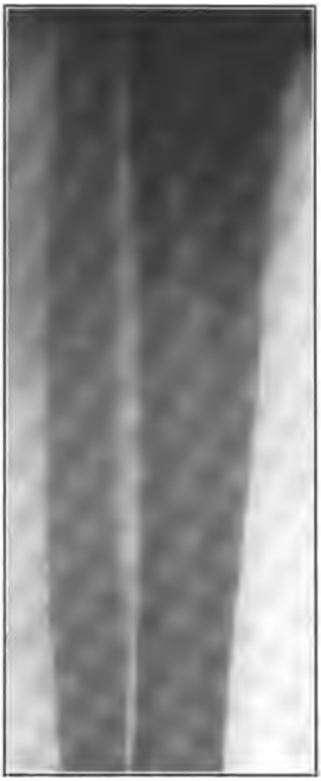


Case I.

Articular Symptoms.—Pain, stiffness, slight loss of function, swelling. Weight, 205 pounds. Has not lost or gained. Same weight for five years.

Recent Infection.—None of the following: Gonorrhea, throat, nose, pneumonia, influenza, typhoid, scarlatina, measles diphtheria, dysentery, syphilis, puerperal, septic processes pyorrhea alveolaris, spine lesions and other infections, gastro intestinal disturbance.

Present Examination.—Build, heavy, tall, well developed and nourished. General condition good. Color, fair, rather blotchy. Temperature 99, pulse 76, respiration 26. Present weight 205 pounds, scalp clean. Pupils, equal and react to light and distance (sluggish). Pharynx and nasopharynx red. Gums, lower, livid. Teeth, fair condition. Ears, no lesion of ear. Hearing normal. Tophi, none. Lymph nodes not enlarged. Skin, no abnormal pigmentation, dry. Reflexes, pupillary, normal, slightly sluggish. Knee-jerks, achilles,



CASE I.

normal. Triceps normal. Biceps normal. Plantar normal. Abdominal normal.

Heart, not enlarged. Apex, inside nipple line, fifth interspace areas of dullness, normal. Rhythm, regular, quality of sounds clear, no murmurs. (A-2-P-20). Pulse (rhythm, volume, tension) regular, fair low. Blood pressure 110. Arteries not palpable.

Lungs (dullness, respiration, râles) resonant throughout, sounds clear and regular, no râles.

Abdomen, fat, soft, tympanitic. Meteorism, none. Liver, not palpable. Spleen, not palpable. Kidneys, not palpable. Fecal masses, none. Spine, flexible, no muscle spasm.

Joints, shoulders, hips, ankles, feet, hands normal, no crepitus. Left elbow painful to pressure, motion slightly limited by spasm at end of range. Right knee slightly painful on motion. Some synovial thickening. Right leg very painful on palpation. Indurated area on outer side of calf about the size of an egg.

MEASUREMENTS.

	Right knee, inches.	Left knee, inches.
Above patella	18 1/2	18 1/4
Over	17 1/4	15 3/4
Below	18 1/2	17 1/2
Elbow, at top of capsule	11 1/4	11 3/4
Over capsule	11 1/4	11 1/4
At bottom of capsule	11 5/8	11 1/8

No loose bodies. No muscular atrophy. Painful on extreme motion. Elbow and knee, slight functional disability.

Urine.—Col., straw; react., acid; Sp. gr., 9, 1910; Alb., 0; sugar, 0; 24 hour ant., 72 oz. *Wassermann* positive.

Subsequent History.—The patient was first seen August 3, 1911. The physical condition was essentially the same, except that indurated area in calf was not then present. At that time there was swelling over the temperomaxillary joint. Under a treatment of potassium iodide and mercury the patient had improved so much by the middle of September, 1911, that she stopped coming to the clinic, and did not return until the time when the present history was taken. The symptom of which she now complained the most was the pain and induration, which incapacitated her. She was given potassium iodide and mercury inunctions. The patient did not return for over a month and reported that she had felt fine while taking the medicine. Intramuscular injections of mercury salicylate grain 1/2 up to grain 1, every other day, were then given, until the gums became red and painful. During this treatment, the symptoms cleared up entirely, the induration in the calf melted away and the joints became normal, showing no swelling. When last seen, the patient reported that she felt fine—Feb. 11, 1913.

One interesting feature of this case is the fact that it followed a trauma to the knee. The pathological condition was a synovitis. This yielded promptly to treatment, but when discontinued, the condition returned, accompanied by a periostitis and a gummatous condition of the calf, which again yielded immediately to treatment.

CASE II.—J. R., female, colored, aged thirty-eight, married, laundress.

Diagnosis.—Luetic arthritis and osteitis. First seen Jan. 31, 1912. Admitted to hospital Feb. 27, 1912.

Family History.—Good.

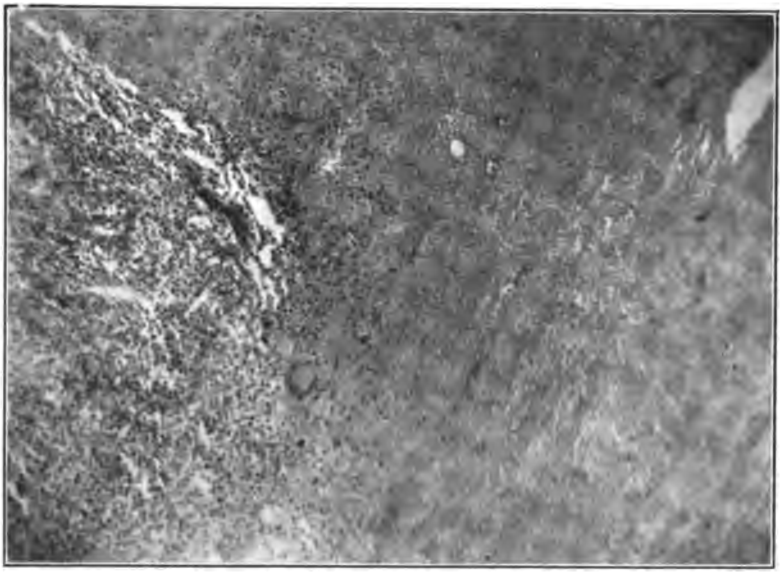
Previous History.—General health has not been very good. Has been sick a great deal, but has not had any specific disease. Had pleurisy at age of thirty, lasting three days. Since age of twenty-seven has had sick headaches. These would come on in afternoon, and would be very bad at night. Vomited often. Lasted about six years. Eyes weak, get tired easily. Lacrymation. For about six months had slight difficulty in breathing through nose. Has had a cold for almost a month. Had night sweats last month; has had pleural pains during last month. Appetite good, until present cold came on. Since then has eaten very little. Gets up twice a night for urination. Denies venereal. Menstrual, first age of eighteen (after marriage). Regular twenty-eight days, last three days, ordinary flow.

Until seven years ago had no paralysis or muscular stiffness. At that time the right elbow was stiff and swollen. Treated in W. U. dispensary. Recovery complete in almost six months. Married twenty-one years ago. First husband died, cause not known. Married again, nine years ago. First and seventh of seven children living and well. The five died very young, cause not known, except one, age three, of meningitis. One miscarriage after first child.

Habits.—Often drinks a bottle of beer, whiskey two or three times a day. Gets meals regularly.

Present Illness.—Right elbow became swollen and painful about five months ago and shortly afterward knees became involved. No other joints. Condition has gradually become worse. For last two months patient cannot walk.

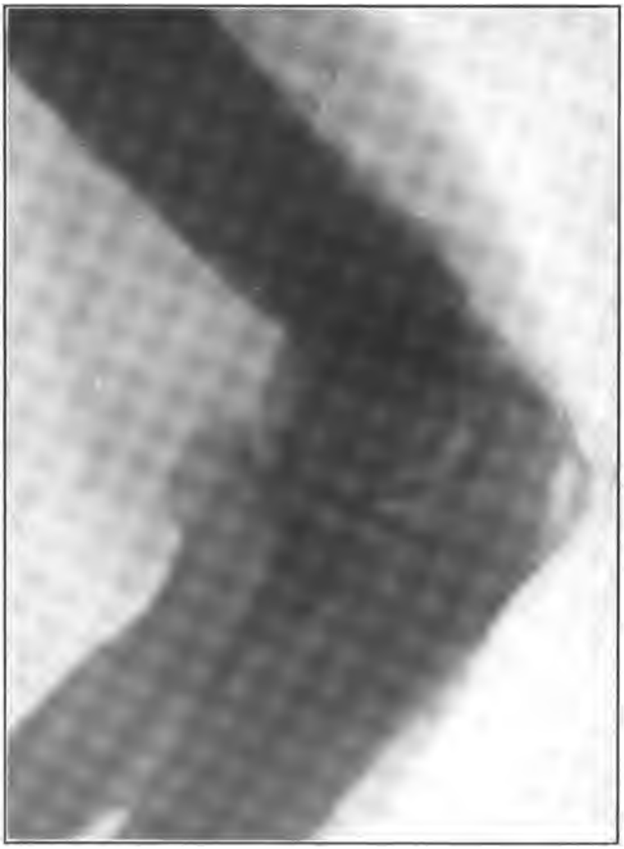
Previous Examination.—General condition, good, except for bad cold. Eyes, pupils, equal and react to light and distance. Ears, drums retracted. Thickening of left drum. Lower post quadrant. No deafness. Throat, tonsils prominent. Nose, has obstruction on account of catarrhal condition. Neck, thyroid gland normal. No general glandular enlargement or pulsations. Extremities, left knee is swollen. The ends of the tibia and femur seem normal. An area of tenderness is found on external and internal aspects of joints. Muscles, strong. Motion limited at knee to almost forty degrees. Elsewhere no abnormal limitation of motion. Left arm strong and no limitation of motion noticed. Elbow swollen and tender. Motion limited to almost thirty degrees. Ulna near elbow



CASE II.—PATHOLOGICAL REPORT. GROSS.—Small pieces of bone and periarticular tissue. Microscopic examination. Necrotic areas, surrounded by connective tissue, infiltrated with epithelioid cells, and by lumpleocytis, are seen throughout. An occasional giant cell is seen. Muscle and bone in some areas is seen, infiltrated by cells. Diagnosis.—Tuberculous osteomyetitis.

(upper one-third) is swollen and tender. Epitrochlear glands swollen to size of hen's egg.

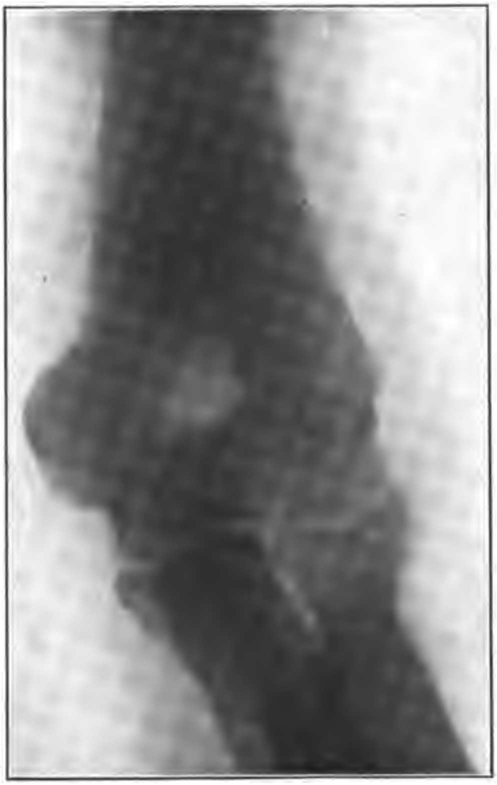
Special Note by Dr. Allison.—"Right elbow, at present there is a general swelling fusiform in shape. Not hot. Allows no motion from twenty degrees flexion to almost right angle.



Case II.

Distinctly palpable enlargement above internal epitrochlear about the size of an English walnut. Surface over olecranon and upper ulna is thickened and tender. Lower end (surface) or humerus is also thickened. Palpable, but not tender. The condition at elbow has improved. There is more motion and less pain. Knees, when entered hospital were flexed at twenty degrees. Left tibia throughout length was rough and tender to touch. Both knee joints contain considerable fluid. Can be flexed to forty-five degrees.

"Right tibia straight. Fairly sharp subcutaneous edge. No crepitus at knees. Legs comfortable, extended. *Wassermann* positive—Feb. 27, 1912."



CASE II.

Urine, dark cloudy; Sp. gr., 1005; sugar, 0; Alb. present. Sed., squamous epithelial cells, leukocytes and granular casts. Blood, red blood cells, 4,168,000; white, 9,400; hbg., 55; color index, 67.

Operation March 5 1912.—Longitudinal incision made over the olecranon 3 inches long. Bursa tense and on being incised a small quantity of purulent fluid escaped. Bursa shows no signs of chronic bursitis, but is full of villi. The periosteum is much thickened. A small portion of ulna cortex removed for examination. Area curetted and wiped out with gauze, leaving clean ulna surface. Wound closed with catgut.

Subsequent History.—Patient put on bichloride and potassium iodide.

Note, March 16, 1912. The wound has stopped draining. Is practically healed. Stitches are out. There has been a most marked improvement in conditions of the joints. The swelling about elbow has almost disappeared. No more tenderness. Motion is alomst normal. The markedly enlarged epitrochlear is now about the size of a bean. Knees are much less painful, swelling gone, and she is able to walk without discomfort.

Pathological Report.—Gross. Small pieces of bone and periarticular tissue.

Microscopic Examination.—Necrotic areas, surrounded by connective tissue, infiltrated with epithelioid cells, and by lymphocytes are seen throughout. An occasional giant cell is seen. Muscle and bone in some areas is seen, infiltrated by cells.

Diagnosis.—Tuberculous, osteomyelitis.—(S. Nicholson, Jr.)

Animal Inoculation.—Report June 20, 1912. Guinea-pig inoculated, March 9, 1912, with bone from patient's elbow-joint. Healthy, no evidence of infection. (S. Nicholson, Jr.)

Social Service report, Feb. 17, 1913, patient's arm seems perfectly well, except a little stiff. Impossible to get her to come to clinic.

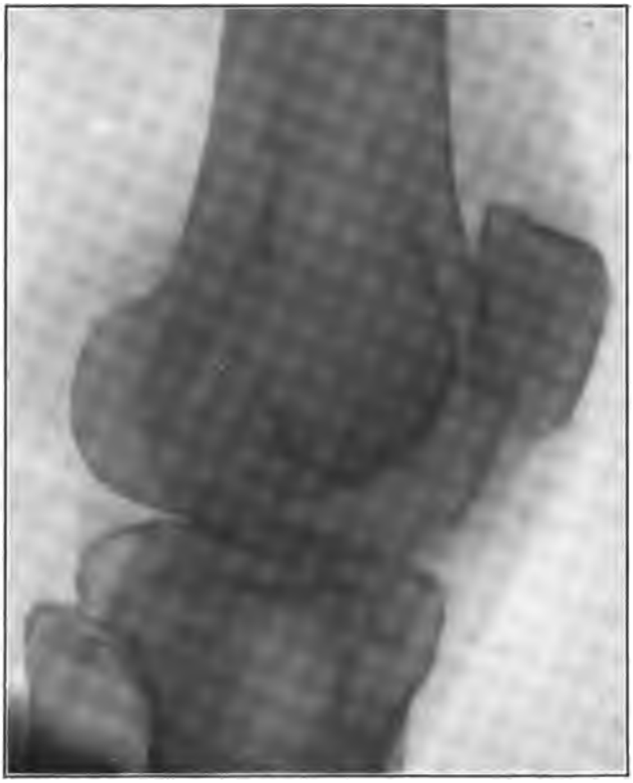
This is a gummatous involvement of the bone and joint; on operation the condition very closely resembled tuberculosis of the joint. The diagnosis was also confirmed by the pathological examination of the specimen removed. The diagnosis of syphilis, however, was confirmed by the fact that when injected into a guinea-pig, the animal showed no symptoms of tuberculosis, and also by the fact that the patient recovered on mixed treatment. This case is of great interest in illustrating the difficulty met with in differentiating between syphilis and tuberculosis of the joint.

CASE III.—N. C., female, white, aged forty-eight, married, general housework. First seen Aug. 31, 1912.

Diagnosis.—Atrophic arthritis.

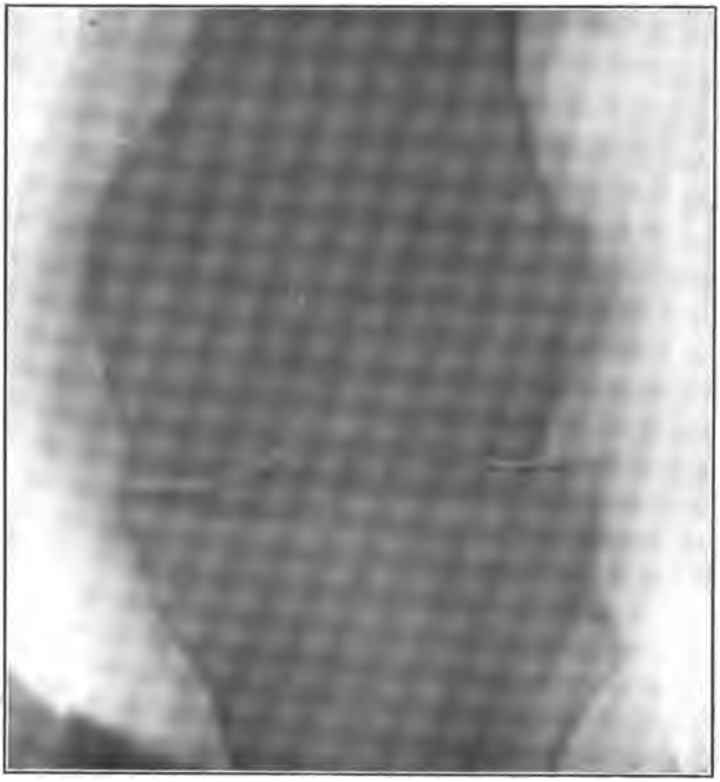
Family History.—Father and mother dead, cause not known. One sister had inflammatory rheumatism. Brother died of "typhoid pneumonia." Patient not living with husband, who was unhealthy.

Previous History.—Has always been pretty healthy. Had small-pox when twelve, mumps when sixteen. Remittent fever. Twelve years ago had swelling in throat, occasional sore throat. Had no other children. No miscarriages. Menstruation, regular twenty-one days. Menopause, four years ago. Bowels regular. Has been nervous since menopause. Was general housework girl. Did laundry work for ten years and was waitress for ten years. Has always worked hard. No especial strain on joints. Hot damp laundries, food at times poor. Habits good.



Case III.

Present Illness.—Four years ago, after menopause, left hand began to swell over knuckles, and was painful on motion. Six months later, pain suddenly went to left foot and right hip. Then right foot was involved. A year later right knee was involved. Other joints except hands and knees improved. Had fever at time of involvement and lost hair before joints were affected. Has had discharge from nose for last three years.



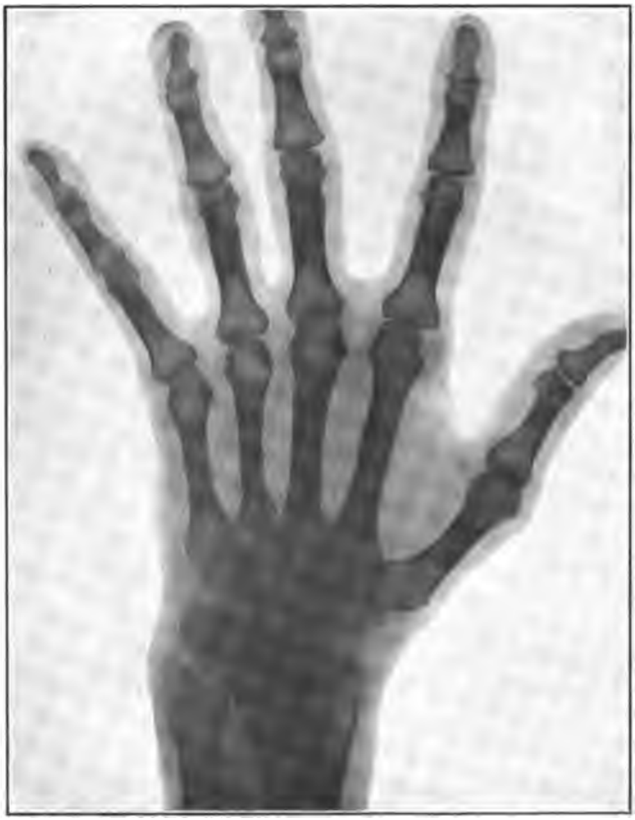
Case III.

Ears discharging for last six years. Feels well except for swelling in hands and knees.

Previous Examination.—General condition fair, slightly pale. Temperature 98.2; pulse 90; respiration 20. Best weight, 160 pounds. Nose and throat and ears (see report below). Gums pale, otherwise in good condition. Teeth, good, except for one molar. Lymph nodes, left epitrochlear and inguinal enlarged. Reflexes, pupillary normal. Triceps and knee-jerks increased.

Heart not enlarged. Regular, sounds not clear. Pulse 2. Slightly increased systolic murmur right apex, transmitted to axilla. Diastolic murmur over aortic. Pulse, regular fair volume, low tension. Blood pressure 127.

Back slightly rigid in all directions, no pain or muscular spasm. Both shoulders, feet, hips, right elbow and left knee normal. Color, normal.



CASE III.

Right knee shows a marked fusiform swelling. Knee fifteen degrees permanent flexion, motion painful. Passive motion to ninety degrees. Both hands show symmetrical enlargement on back over first phalangeal joints. Motions painful. Slight thickening in left elbow. Motions practically normal. No pain. Right knee, 14 1/4 inches; left knee, 13 inches; right thigh 12 3/4 inches; left thigh, 13 3/4 inches.; right calf, 11 1/8 inches; left calf, 11 1/2 inches. *Wassermann positive*—Oct. 22, 1912.

Report of Ear Examination.—Chronic purulent otitis media.

Report of Nose and Throat Examination.—Crushing of mid-meatus left and pharyngeal tonsil.

Gyn. Report.—Chronic urethritis and bartholinitis. Gonococci not found. Symptomatically with atrophic vagina and uterus.

Subsequent History.—Patient was sent to nose and throat clinic and to ear clinic for those conditions, which promptly yielded to treatment. A light brace was applied to right knee. The condition was supposed to have been the result of septic processes in nose and ear. The general treatment consisted in keeping the bowels open and the administration of urotropin. There was some slight improvement. On October 22, 1912, a Wassermann test was made and found positive. The patient was then given potassium iodide and ung. hydrarg. There was considerable improvement but the postassium iodide had to be given up on account of constitutional effect on patient. The administration of mercury was continued with considerable improvement. On November 30, patient reported that she felt much better, could hear and see better. On Dec. 9, 1912, patient was given an intramuscular injection of .9 gram neosalvarsan. The patient was sent home and was not seen for two weeks. Returned without brace, could walk with only slight discomfort. The swelling over phalangeal joints had diminished and hands were more flexible. Knees could be straightened practically to normal and could be flexed at ninety degrees. Patient felt well except for some pain in buttock.

MEASUREMENT OF KNEES.

	Right knee, inches	Left knee, inches
Above patella	12 1/2	12
Over patella	13 1/4	12 1/4
Below patella	13 1/4	11 1/2

Since then patient has had two more injections of neosalversan and at about two weeks intervals. One of .9 gram, other .6 gram. Between injections patient was given hydrarge bichloride, gr. 1/25 three times a day. The improvement has been most remarkable. The patient had gained 8 pounds in less than three weeks. The knee is straight and without pain. Motion well beyond a right angle. Measurements of both knees are alike. There is still some thickening over hands as a result of destructive process, but the fingers are perfectly free and motion is normal. The patient is working, the first time in over a year, and reports that she never felt better in her life.

This case is probably the most interesting one of the series. The picture was that of a typical atrophic arthritis. When first seen, no history of syphilis was obtained. The X-ray showed the changes found in an osteoarthritis. The etiological cause was to be found also in the chronic suppuration in the ear and nose. When the investigation was begun the more minute history aroused the suspicion of syphilis, which was later confirmed by the Wassermann. The improvement under mixed treatment was gratifying, but not wonderful. On the other hand, the change following the injection of neosalvarsan, was most startling and suggestive. In this there seems to be no doubt but that syphilis was the direct cause of the osteoarthritis condition.

CASE. IV.—E. B., female, white, aged thirty-seven, married, housework. First seen Aug. 3, 1912.

Diagnosis.—Infectious arthritis.

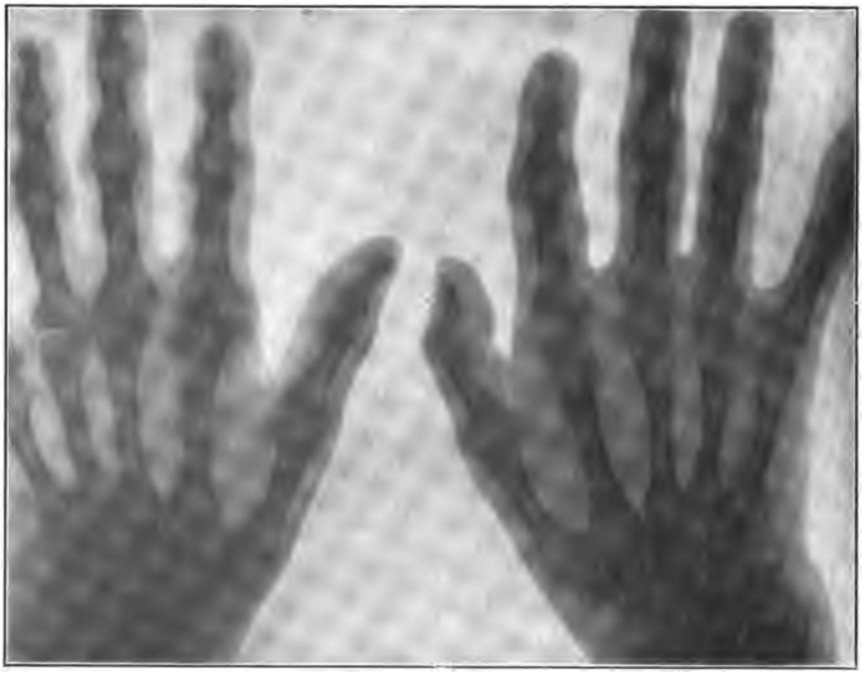
Family History.—Father died of softening of the brain. Always more or less sickly. Mother died of congestive chills. Not living with husband for about one year.

Previous History.—Usual diseases of children, always healthy, two years ago had rheumatism. Sore throat last year, hair fell out about two years ago. Four children, none dead, no miscarriages. Two youngest ones well, boy has skin trouble and discharge from ears. Girl delicate. Patient has leukorrhea; twelve or thirteen years ago had blisters on face. "Bad blood."

Present Illness.—Seven years ago had pain in back, below shoulders. Has been getting worse. One year ago both hands began to swell and were painful. Feet, next involved, then arms. At present pains jump from one joint to another. Hurt most when moving and when lying on back. Hurt worse at night.

Previous Examination.—General muscular atrophy. General condition poor. Temperature 96.6. Teeth very bad. Thyroid slightly enlarged. Reflexes present and active. Heart sounds not strong. Pulse volume low. Blood pressure 108. Joints, motions of right shoulder limited in all directions;

painful. Metacarpophalangeal joints enlarged over index- and middlefingers. Painful. Both wrists same. Thickening of wrists greatest over ulna. Crepitus in left wrist. Cervical spine limited in all directions. Painful on forward and backward bending. Spine rigid in forward bending. Lateral bending fairly free. Pain slight. Left ankle has crepitus. No pains. Feet flattened. Marked hallus valgus. Wassermann strongly positive. Jan. 23, 1913.



CASE IV.

Gyn. Report.—Endocervicitis. Salpingitis, possibly cancer of cervix. Dr. F. J. Taussig. Operated on gynecologically Oct. 31, 1912. Curettage. Anterior fixation of uterus. Adnexa negative. Dr. Schwartz.

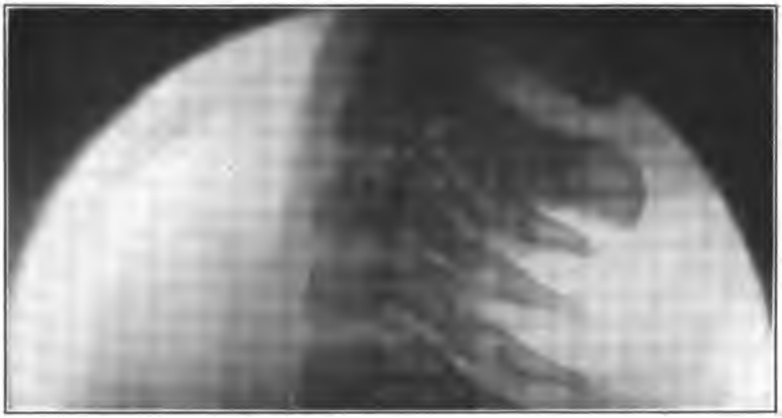
Subsequent History.—Patient when first seen was given thymus gland. No marked improvement. She was then put on urotropin with similar results. She was not at the clinic from Oct. 5 to Dec. 6. This time was spent in Hospital for Gyn. operation. At that time the condition had not improved. On Dec. 16, bichloride gr. 1/25, KI gr. xii, was given. There was a very slight improvement. This was before the Wassermann was obtained. It was discontinued in order to get a Wassermann. As soon as the Wassermann was found positive patient was put on mixed treatment again. Feb. 14, 1913, patient feeling badly in joints. Continued mixed treatment. There has been some improvement. Is to have neosalvarsan injection.

This case is very similar to the preceding one.

CASE V.—L. V., female, white, aged nine, school. First seen Aug. 8, 1912.

Diagnosis.—Tuberculosis of spine.

Family History.—Father living, separated from mother. Has history of syphilis. One other child, living and well. Four miscarriages.



CASE V.

Previous History.—When seventeen days old was in hospital with serious eye infection, probably ophthalmia. Always delicate. Had mumps when four years old. One year ago had swelling on tibia as a result of kicks, had lasted up to present time.

Previous History.—Five days before coming to clinic, struck back of head. Developed pain in neck. Most painful at night. Restless at night. Cries out with pain.

Previous Examination.—Poorly developed and nourished. Teeth irregular. Tonsils, large and red. No marked muscular spasm in neck, except in trapezius, with some thickening on left side over this muscle. Motions fairly free and without pain in all directions except on forward bending, which is markedly restricted by pain and spasm. Spine held rigid on account of pain in neck. Moderate left, total scolioses. Saber legs. Wassermann positive. Aug. 20, 1913, von Pirquet negative.

Subsequent History.—Thomas collar was applied and patient was given gray powder gr. i, t.i.d. There was some moderate improvement in the symptoms, but patient was unable to go without collar. The treatment was rather irregular as the patient could not attend clinic faithfully. On Dec. 19, 1912, patient was referred to Children's Hospital and was given neosalvarsan in buttocks. The patient was not again seen until January 16, 1913. At that time there had been a marked improvement. The patient was feeling well, appetite was good, slept well. General appearance was much improved. Does not complain of any pain whatever. Was getting gray powder, gr. i. Three times a day. Patient was told to omit Thomas collar. When seen, February 1, 1913, had been going without collar since last note. Was feeling fine, had no pain, motions of neck were free and painless. General condition was good.

This case is of interest from the fact that if syphilis had not been sought for the condition might readily have been mistaken for an early tuberculosis of the cervical spine.

The fact that the neck condition immediately followed a trauma is of interest. This case illustrates the advantages of the Wassermann, and the therapeutic value of neosalvarsan.

CASE VI.—S. H., female, aged thirty-five, colored, married, housework. First seen Sept. 20, 1912.

Family History.—Mother died of pneumonia.

Previous History.—When child had measles, mumps, whooping-cough. Had trouble in knee seven years ago. Knee became stiff, did not pain, but was much swollen, after short time got well. Menstruated at 13. Had profuse hemorrhage at each period, lasting a week or more. Very painful. Operated, 1911, for tumor of uterus. Since then has not menstruated. Has had throat trouble. Appetite poor. Keeps bowels open with cathartics. Had discharge "whites" after marriage. Denies "lues." Was cook before marriage. On feet all day. Exposed to heat and cold. Work easier after marriage. Dwellings fair.

Present Illness.—Trouble in both knees since spring. With that had swelling of abdomen. Started in ankle, then in about two or three months involved left knee and later right knee. Pain, motion limited. Had bloating of abdomen latter part of each month. Pain, now only at times.

Previous Examination.—Temperature, 97.6; pulse, 78; respiration, 22. Teeth good, except upper incisor. Slight increase in reflexes. Blood pressure, 95. All joints normal except right knee. Right knee moderate symmetrical swelling. No increase in surface temperature. Moderate synovial thickening. No fluid. Moderate muscular spasm. Motion only slightly limited in extreme flexion. Only slight sensitiveness in extreme flexion. Very slight functional disability.

Measurement of Knee.—Right above patella, 40.5 cm.; left, 39 cm.; right, over patella, 34.5 cm.; left, 33 cm.; right, below patella, 45 cm.; left, 42 cm.; *Wassermann* negative. Oct. 9, 1912. Had probably been taking mercury. Positive Oct. 29, 1912.

Subsequent History.—Strapping and asperin gave little relief. After second Wassermann inunctions of mercury. Moderate improvement followed. The patient was then given injections of mercury, salicylate with marked improvement in spite of fact that treatment was irregular owing to failure to attend regularly and on account of moderate salivation which necessitated omitting treatment for a while. On January 9, 1913, patient was given 9 grains neosalvarsan.

CASE VII.—F. J., male, aged thirty-two, white, laborer, married. First seen Oct. 21, 1912.

Diagnosis.—Osteoarthritis of back. Sacroiliac strain.

Family History.—Not important.

Previous History.—Measles when child. Had lues thirteen years ago. Had been under treatment more or less since. Gives definite history of chancre. Had sore throat and rash at times of infection. Constipated last year. Stomach easily upset. No alcohol. Exercises daily with indian clubs and walks about twenty-four blocks. Main work lifting and stooping. Condition of dwellings good.

Present Illness.—Has had pain in small of back for four years. Came on suddenly, often lifting. Would rest a few days and pain would leave. Lately attacks have been more frequent. Pain is dull in character, usually localized in small of back, but occasionally radiating to left hip. No areas of tenderness on pressure. Has lost almost 6 pounds.

Previous Examination.—Fairly developed and nourished.

Slightly pale. Pharynx slightly red. Gums show moderate retraction. Small inguinal, cervical and epitrochlear glands. Hands clammy. Knee jerks slightly increased. *Blood Pressure* 124. Spine rigid, marked muscular spasm. Sacroiliac sign positive in left leg. Wassermann negative. (Oct. 31, 1912.) X-ray (Oct. 21, 1912). Shows marked atrophy of intervertebral discs, with some hypertrophic changes.

Subsequent History.—Temporary strapping of back relieved acute sacroiliac symptoms. Was put on bichloride and potassium iodide. Has been wearing no supports, since first strapping, but has shown steady improvement, has been working steadily. Feb. 12, 1913, has gained weight. Feels fine. Back has not pained at all for last two weeks. Spine much more flexible, no muscular spasms; no pain.

This case was apparently a typical sacroiliac strain. It is of interest, however, in the suggestion that syphilis may have a part in prolonging the condition, or that the arthritic changes may have been syphilitic following the original trauma. The fact that he has steadily improved under anti-syphilitic treatment, would tend to confirm this supposition.

CASE VIII.—P. B., aged twenty-eight, white, married, housework. First seen Oct. 21, 1912.

Diagnosis.—Osteoarthritis of spine.

Family History.—Three children living and well. One dead, after hair-lip operation. Two miscarriages.

Previous History.—When a child, patient was subject to tonsilitis, has not suffered recently. Had measles and diphtheria. Appetite good, bowels irregular. Uses cathartics. Denies venereal. Had "whites." Thrown from wagon four years ago, no serious injury. Uses tea, coffee and alcohol. Meals regular. Worked in factory before marriage. Also in private families. Does own housework. Hair falling out.

Present Illness.—Neck getting rigid. Complains of severe headaches. Worse at night. Neck painful all the time. Worse at night. Onset, six months ago.

Previous Examination.—Thin, fairly well developed. Color, slightly pale. Tonsils large. Pharynx red. Neck flexible on forward and backward bending. Rotation of head painful. Back rigid on forward bending. More flexible on side bending. *Wassermann positive* (Oct. 22, 1912).

Subsequent History.—Patient did not attend regularly. Put on bichloride of mercury and potassium iodide. The social service department could not locate her at the address given.

Case IX.—L. B., aged twenty-six, white, female, single, cashier. First seen Nov. 26, 1912.

Family History.—One brother died of diphtheria. Mother had one miscarriage.

Previous History.—Had measles when child. At five years of age developed multiple arthritis, both hands and knees involved. Pain left hand. Periodical swelling of knees. Knees would be swollen for two or three days, and then would be well as many months. Menstruated about fifteen, regular and painful. One and a half years ago had two sores, two months later had eruption on sides and face, sore throat. Hair fell out, treated for six months. All joint symptoms were better during treatment.

Present Illness.—For last two or three weeks, has had pain in ankles and feet. Painful to pressure in morning, more of a discomfort, onset sudden.

Previous Examination.—Temperature, 99.0; pulse, 96; respiration, 22. Pharynx red. Cervical and epitrochlear glands palpable. *Blood pressure* 114. Gynecological report. Internal and external genitals, normal, no discharge.

Joints, wrists atrophied with only a few degrees of motion. Phalangeal joints normal except thumb on left hand, adduction, limited. Motion of elbows and shoulders normal in range, some moderate crepitus. Hips normal. Knees both show fusiform swelling, greater in left. Motions limited by bony obstruction. No pain, some synovial thickening, fine soft crepitus. Surface temperature, not increased. Motions of ankle free, no swelling, slight crepitus in left. Back, stands with sway-back. Motions of spine restricted in all directions.

MEASUREMENTS OF KNEES.

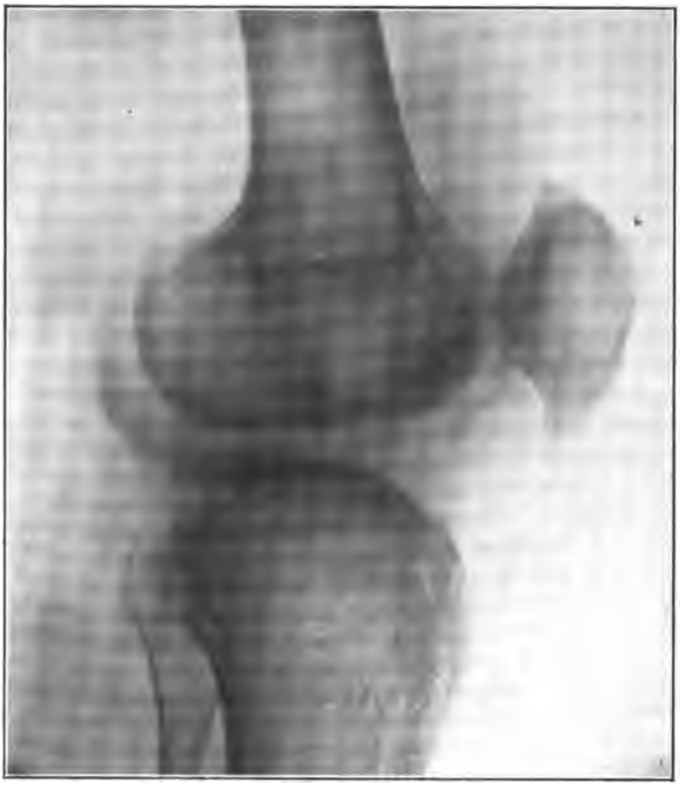
	Left knee, inches.	Right knee, inches.
Above patella	12 1/2	12 1/2
Over patella	13	13
Below patella	13 1/2	13

Urine normal. Wassermann, not made.

Subsequent History.—Rather nervous temperament. Injections of mercury salicylate did not give much benefit. Condition remained about the same. Better one day, worse the next. On whole, however, there seemed to be some improvement. Bichloride of mercury and potassium iodide seemed to give a little better results. Worrying a good deal about condition.

Jan. 18, 1913, given intervenous injection of neosalvarsan .9 gm. Some slight improvement after this. Still continues to worry, and complains of pains and aches.

This case is apparently a case of Still's disease, upon which a syphilitic arthritis has been engrafted. The original condition had not caused any trouble, until the Syphilitic infection.



CASE IX.

CASE X.—C. G. Male, aged forty-one, colored, married, waiter. First seen Nov. 16, 1912.

Diagnosis.—Syphilitic periarthritis.

Family History.— Father dead, cause not known.

Previous History.—Usual diseases of childhood. Otherwise always well. Had gonorrhea two or three times, last about fifteen years ago. Had syphilis fourteen or sixteen years ago.

Present Illness.—Ten weeks ago had pain in both shoulders, pain gradually attacked all joints of body. Right wrist and knee were swollen. Motion, increases pain.

Previous Examination.—Well developed and nourished. General condition good. General physical examination shows nothing abnormal. All joints sensitive on motion.

Subsequent History.—Patient was given potassium iodide, gr. xv, three times a day. Did not return until Jan. 25, 1913. Said that potassium iodide had helped a great deal. Had been in Hot Springs, Ark., since last seen, taking baths. At this visit complained of pain in neck and spine and both hips. Also pain in right knee. Hurts only when he twists knee. Wassermann taken at this time quadruple plus. Was given mercury bichloride gr. 1/25 and KI gr. xv. When seen five days later, was very much better. Medicine continued.

This case is interesting as showing the late manifestation of general syphilitic intoxication, and synovitis. The patient promptly responded to treatment. It is also striking as illustrating the necessity of more thorough treatment in syphilis. Since the original infection, the patient had taken treatment on and off. As soon as the symptoms had disappeared treatment was stopped.

Case XI.—L. B., female, white, aged forty-two, married, housework. First seen Nov. 7, 1912.

Diagnosis.—Hypertrophic arthritis. Referred from medical clinic.

Family History.—Mother living, had inflammatory rheumatism on and off. Three children have had tonsils removed. One daughter eleven years old, weighs 116 pounds. One miscarriage, after a fire.

Previous History.—Measles. Tonsilitis, three years ago. Passed bloody mucous stools, before onset of present trouble. Always stout. Two cups of coffee, or three cups tea a day. Urinates once at night. No exercising, except work. Condition of dwellings good.

Present Illness.—Ten years ago, ring finger of right hand became swollen, in about two weeks elbow, shoulders, knees and feet were involved. No fever. Joints were painful, hot and rigid. Patient had bronchitis for some time. At present practically all joints are well except hands. Had tooth abscess for nine months, six or eight months after arthritis developed.

Bowels irregular, diarrhea followed by constipation. At present can eat almost anything.

Previous Examination.—Fairly nourished, slightly sallow. Best weight 195 pounds, weight at present 178 pounds. Pupils react slowly to light and accommodation. Throat slightly red. Gums pale, upper teeth false, two incisors decayed. Reflexes decreased. Heart sounds indistinct. *Blood pressure* 95. Joints: Atrophy of both wrists, and all metacarpophalangeal joints of right hand, second joint middle finger (left) atrophied and rigid. Crepitus in left shoulder. Motions normal. Back flexible, not painful. Left hip, slightly painful. Motions normal. Both feet flattened rigid, painful on manipulation. Wassermann positive, January 28, 1913.

Subsequent History.—Asperin gr. x, three times a day, relieved symptoms. These returned when asperin was discontinued. Given neosalvarsan. .6 gm. Feb. 5, 1913, intramuscularly. Condition has been about the same. There has been some moderate improvement.

This is a case treated as osteoarthritis for a number of years. The condition was not very active. The bone changes were probably due to a syphilitic intoxication, acting as any other toxine which produce these changes. This theory is supported by the fact that the patient improved after mercury and neosalvarsan, but this improvement was not as quick or as remarkable as in Case. No. III. In Case III, syphilis was probably the direct active cause.

CASE XII.—J. T., female, married, aged thirty-nine, milliner. First seen Nov. 27, 1912.

Diagnosis.—Osteoarthritis.

Family History.—Father died of blood poisoning, suffered occasionally with rheumatism.

Previous History.—Usual diseases of childhood. Frequent attacks of malaria. Pleurisy, three years ago. Appendicitis two years ago. Had slight attacks of sore throat. Two children living, always "delicate," two miscarriages. Leukorrhea several years ago.

Present Illness.—Has had rheumatism for eighteen years, first attacks slight, later becoming more severe. For last two years attacks have necessitated patient's going to bed. Joints swell, very painful and are sensitive to pressure. Attacks accompanied by fever, pain and swelling worse in hands and feet. Had severe headaches, lasting several days. Worse during the day. Bowels regular.

Previous Examination.—Slight stiffness in both wrists. Fingers on both hands are painful, tender and swollen. Slight limitation of spine on forward bending. Both feet moderately flattened. Treatment, potassium iodide, gr. xii increase a grain a day. Wassermann positive.

Subsequent History.—Dec. 30, 1912, reported that she felt about the same, but had been much better while taking the potassium iodide. Given bichloride 1/25 gr. potassium iodide gr. xv. The patient has been much improved by treatment and is working every day.

This case illustrates the advantages of a Wassermann in case of "Rheumatism."

Case XIII.—F. W. Male, aged thirty-one, married, colored, teamster. First seen Nov. 30, 1912.

Diagnosis.—Syphilitic arthritis.

Family History.—One brother, possibly has tuberculosis.

Previous History.—Measles. Had trouble in knee, during summer, probably from carrying hod. Had gonorrhea twice, but not with present infection. Had chancre, three weeks before onset of present trouble, now healed.

Present Illness.—Ten days ago, began to have pain in back and knees. Came on after being wet. Now has pain in all joints, but most acute in lumbar region. Very painful at night.

Previous Examination.—General glandular enlargement—especially epitrochlears. No rash. All joints, sensitive on motion. No swelling or other local symptoms. Back held rigid on account of pain. Wassermann not made on account of positiveness of diagnosis.

Subsequent History.—Given bichloride gr. 1/24, potassium iodide gr. x, showed some improvement in two days. Was then given intramuscular injections of mercury salicylate. Objected to pain of injection, and did not return to clinic. Was looked up by social service department Feb. 12, 1913, and has been treated at city dispensary, very much improved.

This is a case of syphilitic intoxication in early secondary stage.

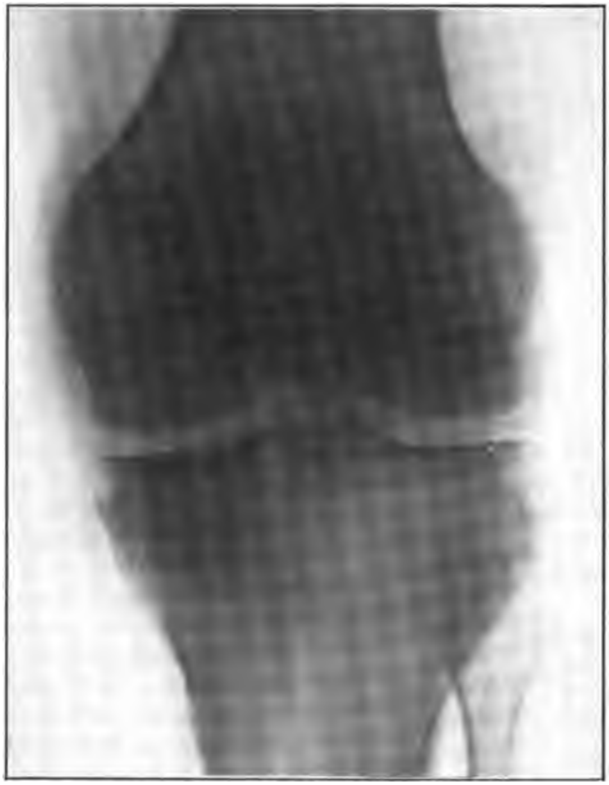
Case XIV.—H. B., male, aged thirty-eight, white, married, accountant.

Diagnosis.—Tuberculosis of knee.

Family History.—Good. Married, no children.

Previous History.—Diseases of childhood. Gonorrhea nine years ago. "Chancroid" nine years ago.

Present Illness.—Onset eight months before first visit. Pain in shoulder, jaw and right knee, mainly in knee, onset gradual, no fever. At present considerable pain and limitation of motion. Pain, not more severe at night.



Case XIV.

Previous Examination.—Best weight, 185 pounds, now 155 pounds. Tonsils large, especially right. Some old scars. Nasopharynx, red. Gums red. Teeth bad, small epitrochlear and inguinal glands. Right knee shows spindle-shaped swelling, increased temperature slightly reddened, twenty degrees motion, painful. Marked muscle spasm. Patella movable. Synovial thickening and a moderate amount of fluid. Wassermann strongly positive, von Pirquet positive.

Subsequent History.—When first seen, diagnosis of tuberculosis of knee was made with a question of syphilis. Knee immobilized. Calomel and potassium iodide were given. No marked improvement was apparent. Later injections of salicylate of mercury, were given. These had to be omitted on account of poor condition of teeth. In spite of this treatment, which was faithfully carried out including immobilization, the symptoms remained about the same. In October, .9 gm. of neosalvarsan was administered intramuscularly. The injection caused considerable pain at site of injection, but the improvement in the joint and general condition was immediate. The pain disappeared, swelling was much less and motion increased to about forty-five degrees.

On January 15, a second injection (intervenous) of .9 gm. neosalvarsan was given. This was followed in a few days by a return of symptoms, in an aggraved form. Has had increased doses of bichloride gr. 1/20 and potassium iodide and at present there is practically no pain in the knee.

This case illustrates the difficulty in making a diagnosis between syphilis and tuberculosis. There was no history of chancre. The patient had had what was diagnosed as a soft chancre. No treatment had been taken. The joint acted exactly as a tuberculous one, but did not respond properly to treatment. Mercury did not give any marked relief either. The marked improvement after neosalvarsan, however, would tend to confirm the diagnosis of syphilis. Also the subsequent improvement with increased doses of potassium iodide and bichloride. The improvement seems to be due to the increased potassium iodide. This is a case of gummatous involvement of the knee.

CASE XV.—R. R., male, aged thirty-two, white, married, horseshoer. First seen Dec. 24, 1912.

Diagnosis.—Static back (syphilis).

Family History.—Good. Wife had one abortion (three months) supposedly from riding in rough wagon.

Previous History.—General diseases of childhood. Had gonorrhea nine years ago. Pain in back, ten years ago. No history of chancre.

Present Illness.—Complains of pain in back and lower legs.

Previous Examination.—Right pupil more dilated than left, react. Throat congested, scar on right tonsil. Pulsating and palpable mass in left supraclavicular region. Postcervical and epitrochlear glands, palpable. All joints but spine, normal. Spine, markedly limited in all directions. Considerable muscular spasm. Blood pressure 117. Wassermann doubtful, Jan. 22, 1913. Wassermann positive. Feb. 19, 1913. X-ray: No changes in vertebral bodies or cartilages.

Subsequent History.—Plaster jacket gave considerable relief to back. Some pain in legs still persisted. Pain in back still persisted, and patient did not feel well. Bichloride gr. 1/30 and potassium iodide, gr. xv gave relief, but this treatment was discontinued in order to get a more conclusive Wassermann. This second Wassermann was positive. Patient was again put on mixed treatment. Patient had only taken treatment for about one month after development of chancre.

This is a case of syphilitic spondylitis. The spine was attacked because it was subjected to the greatest strain.

CASE XVI.—M. J., male, aged thirty, white, single, carpenter. First seen Dec. 26, 1912.

Diagnosis.—Tuberculosis of spine.

Family History.—Understood that father was a heavy drinker.

Previous History.—When eight years had painful abscess over upper part of sternum. Healed quickly. Malaria when twenty, lasted about six months. In weakened condition for year; similar milder attacks almost every summer. Had sore back since first attack of fever, when fever returned back would be very sore. Pain not constant. When twenty years old had pneumonia all winter. Slightly constipated for last few years. Gonorrhea twice, when seventeen years old and about eight years ago. When nineteen years of age had sore accompanied by buboes on left side. Eight years ago had "very little" sore, not painful, glands in inguinal region became enlarged and hard, not especially painful. About four weeks later had eruption. Took baths at Hot Springs, rash disappeared. Also had sore throat at time of rash. Drank to excess for about ten years. Now takes a little beer and wine.

Present Illness.—Dull pain in back. Has pain since twenty. Worse when lying down, whether day or night. Worse in winter. Pain over spine and between shoulder-blades.

Previous Examination.—Pale, pharynx, slightly red. Pyorrhea and retraction of gums. Few posterior cervical and inguinal glands palpable. Reflexes diminished. Spine rounded kyphos in dorsal region. Lordosis in lumbar region. Muscle spasm marked. Spine rigid on forward bending, also in lateral bending. Motion present is in lumbar spine. Cervical spine freely movable. Prominence of tenth dorsal vertebra. X-ray shows lipping of vertebræ in dorsal region. Urine normal. *Wassermann positive.* Tuberculine reaction negative. No tubercle bacilli in sputum. Given .6 gm. neosalvarsan.

Subsequent History.—Reported to clinic, feeling better, given mixed treatment.

This case showed the typical symptoms of tuberculosis of the spine. The Wassermann, however, was positive, while a tuberculine reaction was negative.

CASE XVII.—L. B., male, aged sixteen, colored, single. First seen Dec. 27, 1912.

Diagnosis.—Specific arthritis.

Family History.—Good.

Previous History.—Mumps when small. Small-pox, two years ago. Gonorrhea six months ago. Chancre at same time.

Present Illness.—Neck became sore, three or four days ago. Stiff and painful on motion.

Previous Examination.—Enlarged epitrochlear glands especially on right. Enlarged postcervical glands. Old scars on tonsils. Cervical spine limited in all directions especially to right and in forward bending. Motions painful. *Wassermann positive.*

Subsequent History.—Patient did not return to clinic.

Social Service Report.—Patient is working in tobacco factory and is entirely well.

This case is given merely as a type.

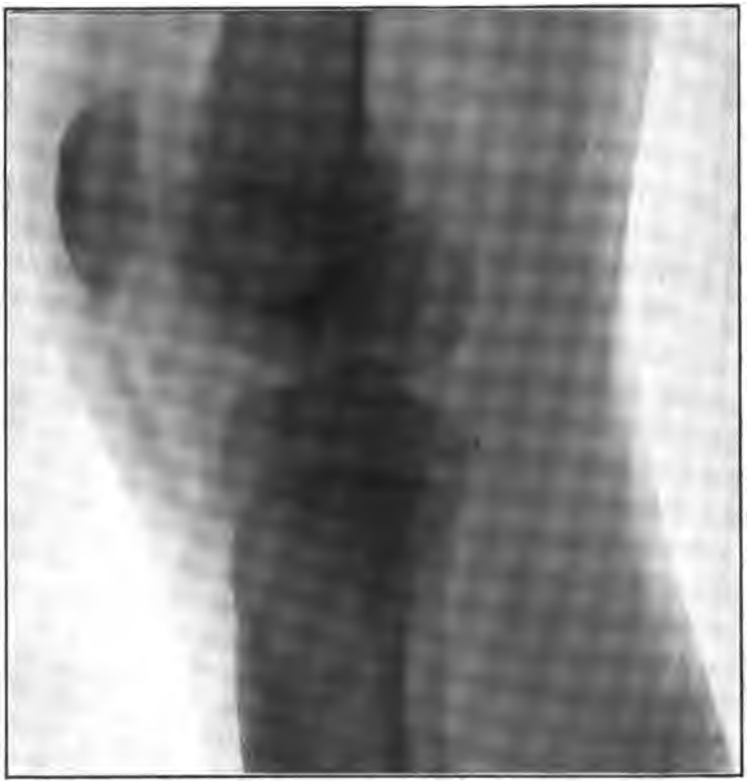
CASE XVIII.—N. D., female, aged eight, white, single, school. First seen Dec. 27, 1912.

Diagnosis.—Multiple syphilitic arthritis. Interstitial keratitis. Referred from eye to orthopedic clinic, through surgical clinic. Put in Children's Hospital. Copy of Children's Hospital Record. *Complaint.*—Soreness left knee, two weeks. Sore eye five weeks.

Family History.—Father and mother, alive and well. First child, stillborn. Second child, died at age of seven years of meningitis (tbc.). Fourth child premature at eight months, died in one hour. Maternal aunt, died of pulmonary tuberculosis seventeen years ago. Father has had mild rheumatic pains.

Past History.—F. T., breast-fed. Eleven months, pertussis as an infant. Pneumonia mild last winter. Has been strong, healthy girl. Appetite is good, bowels regular and sleeps well.

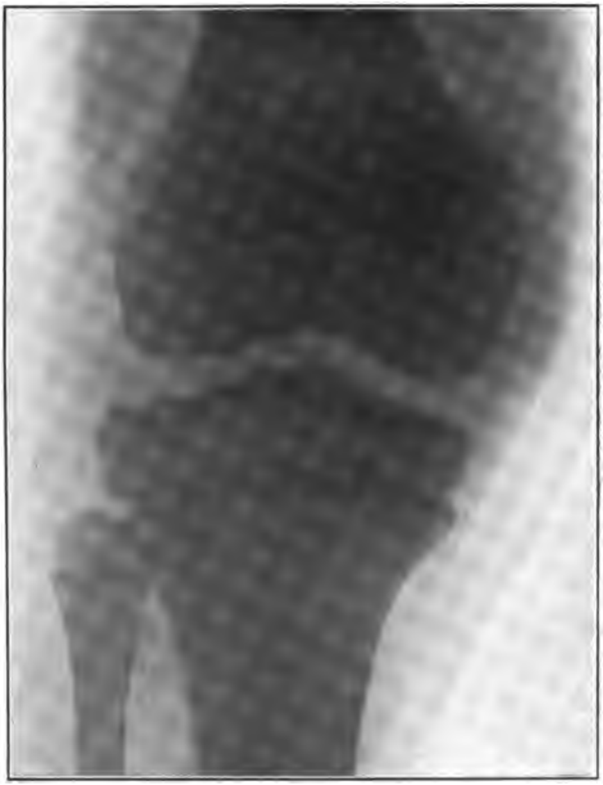
Present Illness.—Past five weeks, has had photophobia, cloudy cornea. Eyes have been treated at O'Fallon Dispensary. Past two weeks, has had swollen, painful knee. No night cries. Has been having 1/2 oz. inunction, blue ointment Q. N.



Case XVIII.

Previous Examination.—Well-developed and nourished girl. Not prostrated. Head well formed. Ears negative. Nose negative. Eyes, dense, opacity, both cornea. Ciliary injection. Center of both cornea slightly bulged and pointed.

Mouth—two upper central incisors are pegged, centrally notched and widely separated (Hutchinsonian). Throat negative. Neck, slightly enlarged gland at angle of jaw, both sides. Thorax well formed. No rosary. Expansion good. Lungs resonant. Breath sounds normal. No râles. Heart—area dullness not increased. Sounds clear. No murmurs. Abdomen, soft, level. No masses, not tender. Spleen, not felt. Liver to costal margin in marginal line. Genitalia negative, except local. No deformity paralysis or edema. Reflexes normal.



CASE XVIII.

Local Examination.—Left knee held rigid by spasm. No motion permitted. Patella riding. Circumference 10 3/4 in. (right side) 10 1/8 in., slight local heat.

Dec. 29, 1912.—Neosalvarsan .9 gm. intramuscularly.

Dec. 30, 1912.—Considerable improvement in knee. Allows some motion. Urine, albumin trace. Numerous granular casts. No sugar. Some acetone.

Jan. 3, 1913.—Circumference of knee 10 1/2 in. Paracentesis to determine nature of fluid. Dry tap.

Jan. 6, 1913.—Considerable improvement during the past week, but yesterday and to-day seems to be retrogressing. Neosalvarsan .9 gm. again given to-day.

Jan. 7, 1913.—Urine, no albumin, sugar or acetone.

Jan. 11, 1913.—General condition remains about same. Eyes, have been having yellow oxide and atrophin ointment 4 I.D. There is marked improvement. Some clearing of the cornea. Knee, circumference right 10 in. Left 10 1/8 in. Voluntary flexion as far as right angle. Has been in traction for past week. Now taking gray powder daily.

Jan. 16, 1913.—Comes off traction to-day. Flexes left knee well without pain. Getting atrophin 1 per cent. to eyes and gray powder. Gr. 1 1/2 I.D. and potassium iodide gr. v. Considerable improvement in knee. Slight improvement eyes.

Jan. 26, 1913.—Patient is up and about ward (sun porch) daily. Eyes are much better, though cornea is still cloudy. .5 gm. neosalvarsan given into muscles of buttock. There has been no vaginal discharge. Irrigation, now only once daily.

Jan. 27, 1913.—There has been much pain following neosalvarsan and rest procured by morphin.

Feb. 4, 1913.—Patient seems just the same. There is no noticed change in eyes. General condition good. No vaginal discharge, but treatment is being continued.

Feb. 13, 1913.—Discharged home. Entirely well except keratitis and this is much improved. Wassermann Dec. 31, positive.

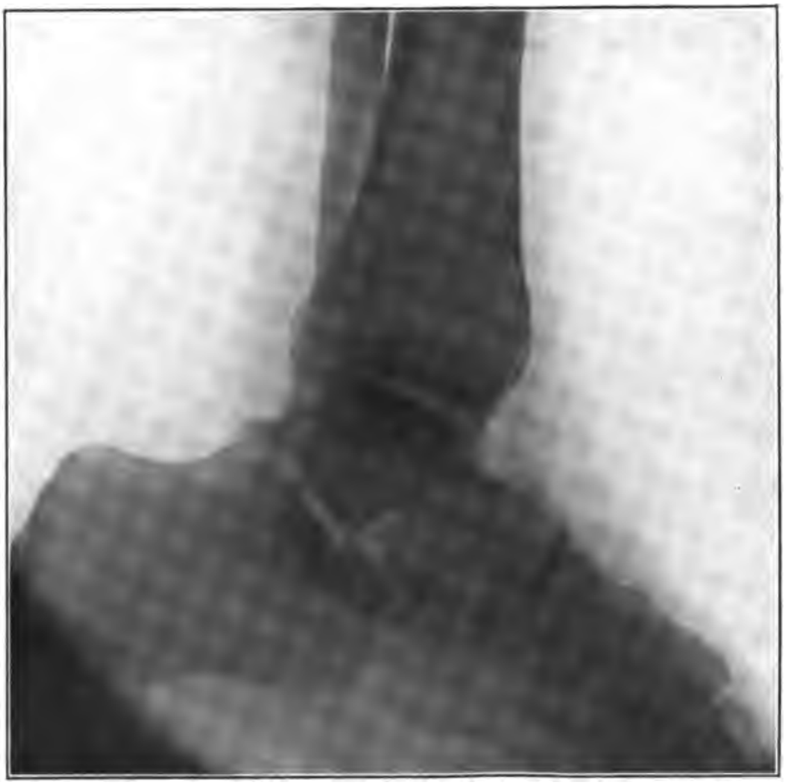
This is of interest as a case of very severe hereditary syphilis. The symptoms developed shortly after the onset of interstitial keratitis and showed no improvement during the treatment for this condition. The effect of neosalvarsan was also remarkable, especially on the joints and also to a less extent on the eyes. It is claimed that neosalvarsan does not have any effect upon congenital syphilis, but in this case and also in Case V, the contrary has been observed.

Case XIX.—C. L., male, aged twenty-eight, white, single, laborer. First seen Dec. 30, 1912.

Diagnosis.—Syphilitic arthritis.

Family History.—Good.

Previous History.—Diseases of childhood. Gonorrhea twice, last time one and one-half years ago. Still has gleet. Had chancre, seven months ago. Driver for express company, on feet a good deal.



Case XIX.

Present Illness.—Complains of slight pain in back and in feet and ankles. Left foot began to pain him one year ago. Right, nine months ago. Onset was gradual with pain and swelling. Some pain in ankles at night. Condition grew better, is now worse. Pain in back, day and night. Has not worked for six months.

Previous Examination.—Sallow, both tonsils large. Mucous patch on right tonsil, also on buccal mucous membrane.

Pharynx red. Gums red. Postcervical, cervical and small epitrochlear glands. Skin dry. *Knee jerks* slightly increased. Blood pressure 134. Back slightly rigid in all directions. Motions, cause moderate pain. All joints normal except feet. Both feet in a position of rigid valgus. Motion painful. Flattened. Tenderness in bottom of heel over os calcis.

Genito-urinary Report.—Posterior urethritis, seminal vesiculitis (J. R. Caulk).

Wassermann Strongly Positive. Subsequent History.—The patient's feet were strapped. He was given mixed treatment. In two days, feet felt somewhat better, while the throat condition has greatly improved. The patient was referred to Dr. Caulk at the genito-urinary clinic for treatment of urethritis. On Jan. 6, 1913, was given neosalvarsan. .9 gm. in Genito-urinary Clinic. On Jan. 9, reported that there were no pains in heels at present. Mucous patches had gone from throat, and only a few small ones remained in mouth. Felt much better, pain in heel returned later. On Jan. 16, 1913, had second injection of neosalvarsan. Patches now gone. Pain again, went away after injection, but returned. Padding helped feet. When last seen felt pretty well except for some pain in feet and heels. Pain in back had entirely disappeared. The condition in the feet is probably due to gonorrhea. The patient is still under treatment for this condition.

CASE XX.—L. S., female, colored, aged thirty-three, married, housework. First seen Dec. 3, 1912.

Diagnosis.—Infectious arthritis, weak feet.

Family History. Father dead. Cause not known. Patient married ten years ago.

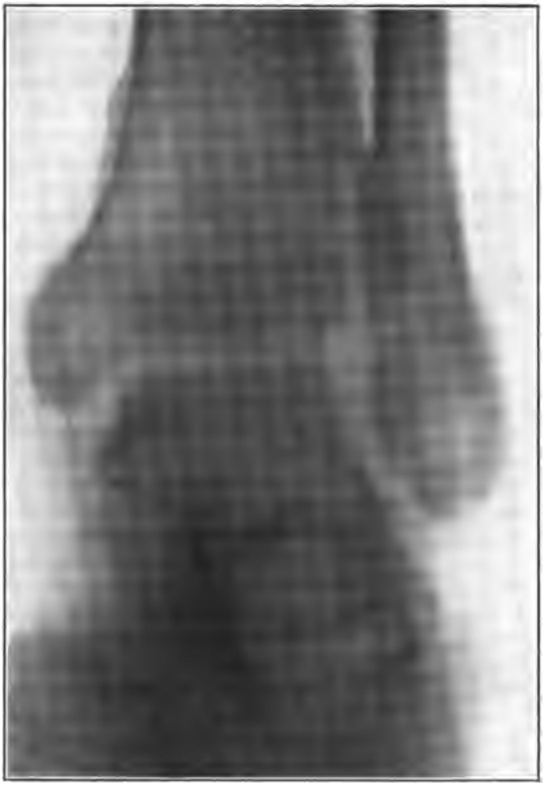
Previous History.—Usual diseases of childhood. Pneumonia, when twelve. Leukorrhea, five or six years ago. No children. One miscarriage. Occasional short periods of sore throat. In 1910, had sore on leg, which lasted about five months. Wassermann made at that time. Eczema last winter. Has pain in "ovaries" when she has cold or before or after menstruation, also headaches, worse at night. Habits good. Dwellings fair.

Previous Illness.—Five weeks ago, woke up in morning, could not get up. Had had a cold previously. Knees, back and ankles were very painful and stiff. Was unable to walk, condition got better and then worse. Now complains of pain in right ankle, which becomes painful and swells on standing.

Previous Examination.—Pigmentation on both legs. Tibia, rough. Blood pressure 119. Arteries palpable. Both knees and ankles slightly swollen, not tender motions free, no crepitus.

Pain over calcaneoastragaloid ligament. Spine, slightly rigid. Both feet pronated and flattened. *Wassermann positive* when first made. On account of fat on arm, did not obtain blood at this time.

Subsequent History.—Some slight improvement, with asperin, gr. v, three times a day. Later complained of pain in ankles and wrist. Jan. 24, 1913, was put on mixed treatment. Jan. 30, reported that she was feeling fine. Symptoms had disappeared.



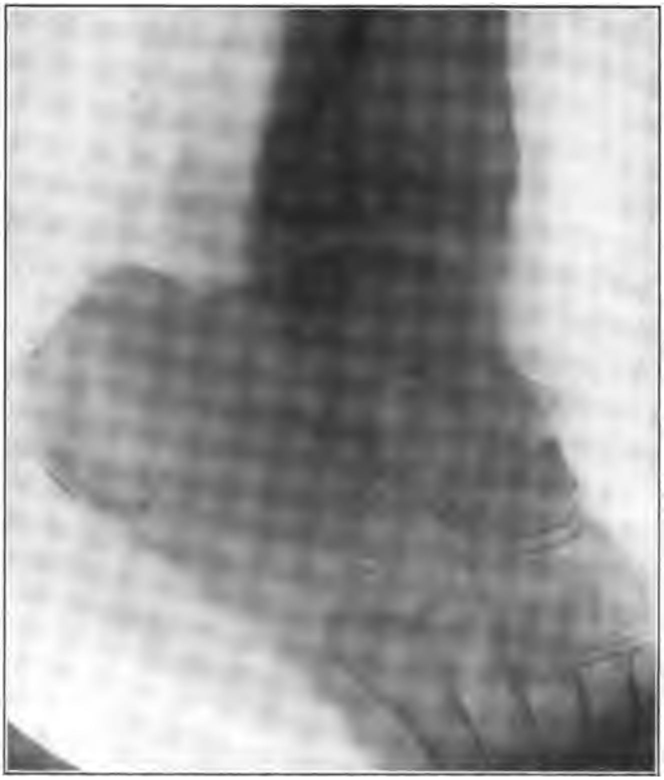
CASE XXI.

CASE XXI.—G. W., male, aged thirty-four, single, white, steelworker. First seen Jan. 7, 1913. Had just come from hospital.

Family History.—Mother died of tuberculosis.

Previous History.—Measles. Pleurisy eleven years ago.

Sharp pains in right side lasted one year. Small-pox, three years ago. Gonorrhea when nineteen years old. "Completely recovered." Syphilis, ten or twelve years ago, after contracting syphilis lump developed on right ankle. Opened, got well. Has had sore throat, at times. Hair has fallen out a little. Up to March, 1912, used alcohol moderately and regularly. Work, as moulder would tend to throw strain on right ankle.



CASE XXI.

Previous Illness.—Two years ago, ankle gradually became swollen and sore. Has not been able to work since March, 1911. In July, 1911, opened and drained, did not help. Was again opened, and drained. Entered Washington University Hospital, March, 1912, ankle was cleaned out. Given potassium iodide and inunctions of mercury. Later given injections. Lump was excised from breast. Is very much better.

Previous Examination.—Hair thin. Exudate on pharyngeal wall. Postcervical glands enlarged. General physical normal. Right leg, muscles atrophied due to disuse. Right ankle, swollen, very large and hard, but not very tender. Skin thick and pits on pressure. Lower ends of tibia and fibula are enlarged. No muscle spasm. Motion without pain, but limited. On inner aspect of joint, skin is red. Two sinuses are seen; one an inch below end of malleolus, and one an inch posterior. On outer side, two scars are seen, one has a sinus just behind tip of malleolus, and the other scar is about 1/2 inch below tip of malleolus.

Pathological Report.—Tissue from foot, necrotic bone inoculated in guinea-pig. Organs of animal at autopsy show no lesions, cultures from organs, sterile. Inoculated April 5, 1912. Autopsy, June 20, 1912 (Nicholson).

Ankle incised and drained April 2, 1912. Urine, nothing abnormal. Improvement was steady after incision and with specific treatment, discharged from hospital May 6, 1912.

Subsequent History.—Since coming to clinic has baked foot every other day, and has had bichloride gr. 1/20 and potassium iodide up to gr. xxvi. Has been steadily improving. Very little pain in ankle. Only a few degrees of motion owing to destruction. Foot held in a position of equinus, owing to operation and shortening of tendo achilles.

This case shows the gummatous stage, and illustrates the destruction which may take place. The patient's work threw a considerable strain on the right ankle.

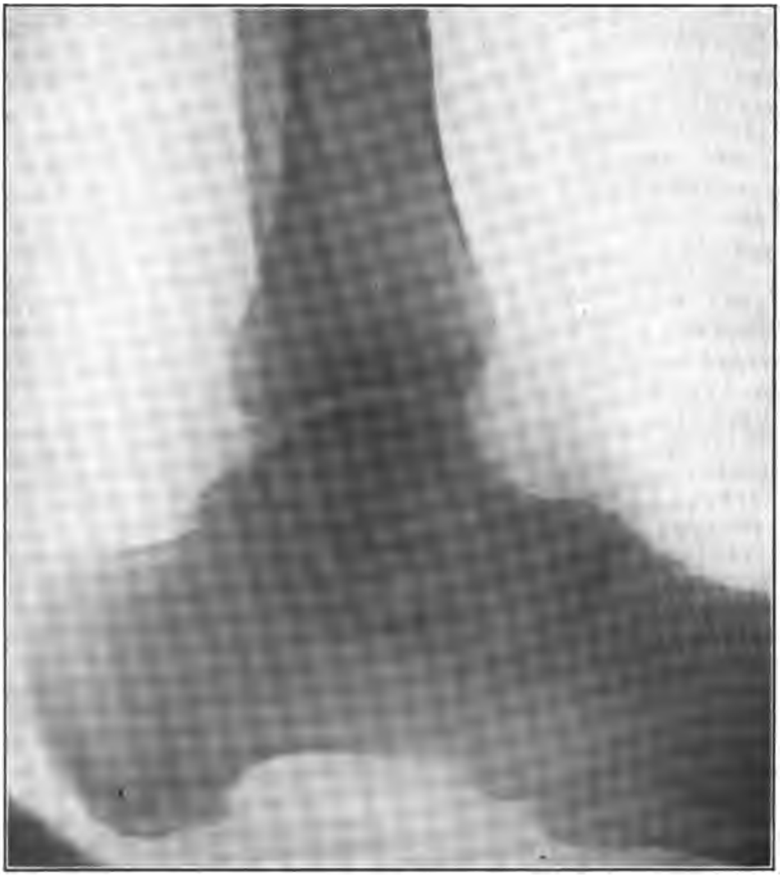
CASE XXII.—N. D., male, aged thirty-eight, white, single, laborer, bartender. First seen Jan. 11, 1913.

Diagnosis.—Syphilitic arthritis, scabies.

Family History.—Mother living, suffers from rheumatism. One sister died of tuberculosis.

Previous History.—Scarlet fever, mumps, measles. Hips and knees suddenly became swollen, thirteen years ago. Painful, no fever, recovered. Gonorrhea, ten years ago. Chancre, three years ago. Took treatment, three months. Has had no sore throat or loss of hair. Has not noticed a rash. Last summer could not eat—nausea. Worked ten or twelve hours a day. On feet most of time. Did not notice tenderness. Excessive use of alcohol, does not drink before breakfast.

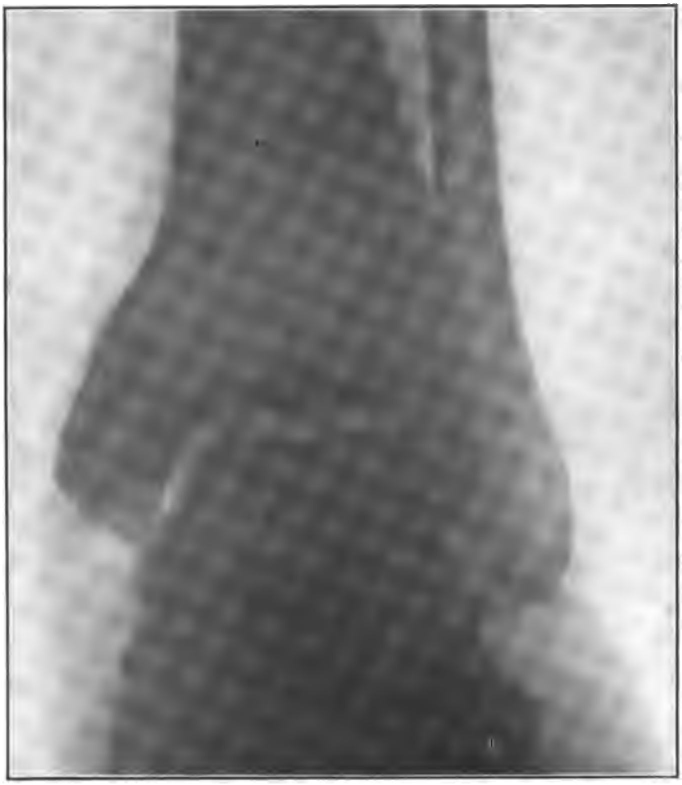
Previous Illness.—Two years ago had pain and swelling in feet, got better. Last summer had pain and swelling again. Had pain on outside of left ankle and on both sides of right ankle. Hurt most during day. Do not keep him awake at night. Has been wearing plates for flat-foot for eight months, with no relief. Came on at same time as gastrointestinal disturbance. Has rash over entire body, very itchy.



Case XXII.

Previous Examination.—Tonsils, red and enlarged. Scar on left tonsil. Nasopharynx red. Epitrochlear glands palpable and hard. Body covered with scabies. Blood pressure 132. Feet pronated with great thickening and induration about both malleoli. The right much more so than the left. Right foot, rigid. Left, fairly flexible. Considerable pain in both feet.

Wassermann—negative. Report unreliable, patient had had several drinks in morning, before blood was taken.



Case XXII.

Referred to Genito-urinary Clinic (Dr. Caulk) for examination.

Genito-urinary Report.—Prostate broad and indurated.

Vesicles enlarged and indurated, secretion shows definite pus (Caulk).

Subsequent History.—Treatment for genito-urinary condition. The patient was put on mixed treatment. Improvement was rapid and has been steady. Patient feels much better. Feet are much less swollen and red. Can walk with more comfort. The skin lesion promptly yielded to treatment for scabies.

This patient had very bad rigid flat feet with considerable thickening in the ankle. It is of especial interest in showing that a syphilitic condition may involve the feet and simulate to a considerable degree flat-foot. In this case, also, there seemed to be a connection between strain and involvement of the joint. The spur formation is probably due to the gonorrheal condition.

CASE XXIII.—C. McK., male, colored, aged fifty-two, married, typeworker. First seen Jan. 21, 1913.

Diagnosis.—Infectious arthritis.

Family History.—Good.

Previous History.—Measles, mumps. Grippe sixteen and ten years ago. Has had rheumatism for fourteen years. Coming on nearly every year, involving knees, shoulders and ankle-joints. Attack severe, onset in a few days. Would last from one to two weeks. Denies all venereal disease.

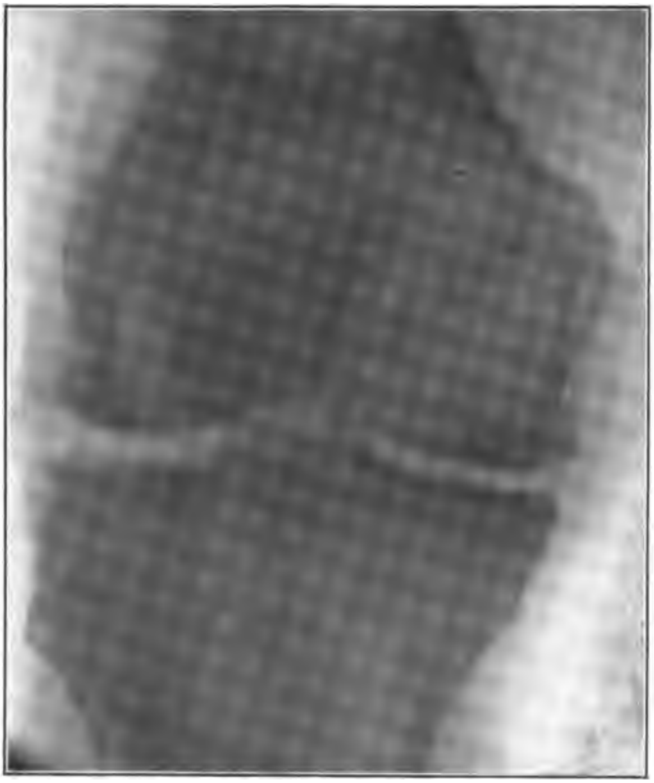
Present Illness.—Three days ago began to have pain under right patella. Next day, knee began to swell and was quite painful. Knee became stiff. Could not sleep on account of pain. Worse at night. Pain also in back and neck. No appetite, bowels regular. Pain a little less severe at present. Now works as type melter.

Present Examination.—Gums show lead line. Teeth carious. Temperature, 99.4. Numerous scars on both legs below knees. Left knee, fine crepitus on motion, no pain, motion, free. Right knee, intense pain on motion. Slight swelling, motion limited by spasm. Crepitus, no fluid.

Measurements.—Left knee, 17 in.; right knee, 17 1/2 in. Wassermann, negative Feb. 19, 1912. Von Pirquet positive.

Subsequent History.—Knee strapped and rest. When next seen in two days, swelling had gone. No increased temperature in joint. Two days later, felt better, but complained of pain in other knee. Put on mixed treatment. Again seen Feb. 14. Reports that he felt fine, while taking medicine but that he began to have pains about a week ago, coming on after last dose of medicine, which has been taken rather irregularly. Now states that first wife had had one miscarriage. Symptoms in hips. When last seen pain had entirely disappeared from knees.

In this case the Wassermann was negative, but this is of no value as the patient had been on a course of mixed treatment, just before the blood was taken. The fact that the pain was worse at night, and also that the condition improved quickly under mixed treatment, tends to confirm the diagnosis. It also shows that syphilis must be looked for, even where there is no history.



CASE XXIII.

CASE XXIV.—T. D., female, colored, aged thirty-one, single, housework. First seen Jan. 23, 1913.

Diagnosis.—Specific arthritis.

Family History.—Good.

Previous History.—Tonsilitis, not married, never had leukorrhea.

Present Illness.—Took "cold" in September. Had "dumb chills." Headaches every morning. Knees, hands and ankles are painful on motion. Pain under shoulder blade. Has pain in knees and feet for a week before menstrual periods. Pain then worse at night. Coughs in morning. Otherwise pain worse in day. Has sensation of crawling in throat.

Present Examination.—Throat red. Tonsils large. Knees, hands and ankles are not swollen, motions normal, but quite painful. Feet flat. Wassermann strongly positive Jan. 28, 1913.

Subsequent History.—Up to five days after treatment there was no marked improvement. Was given mixed treatment. Did not return to clinic. The inference is that she is better. Looked up by Social service and report made that she was not at address given.

This case illustrates the necessity of looking for syphilis in all those cases where there is no marked joint tenderness with no symptoms of inflammation, and whenever the pains are multiarticular and the history rather vague.

CASE XXV.—H. F., male, aged nineteen, white, single, tin factory.

First seen Feb. 3, 1913.

Diagnosis.—Specific arthritis.

Family History.—Mother had no miscarriages or still-born children.

Previous History.—Always well, denies gonorrhea or syphilis, no loss of hair. Works in factory, where he uses his right leg constantly in shifting levers. Has swelling in joints almost once a year and then gets better.

Present Illness.—Present trouble for about two weeks. Right knee has been continuously painful. Pain is not severe. Worse during the day.

Previous Examination.—Tonsils large, crypts open. Inguinal glands enlarged. Right knee, slightly swollen. Motions free, little pain on motion. Slight increase in surface temperature. Wassermann strongly positive Feb. 4, 1913.

Subsequent History.—Knee was strapped, patient was given asperin gr. v. Was to have reported to clinic to get result of Wassermann, but did not return.

Social Service Report.—This patient is working regularly in a tin factory. Is perfectly well.

This case gives the history of all intermittent hydrops; it is also interesting in that no history of gonorrhea or syphilis could be obtained. The joint involvement also seems to be connected with strain.

CASE XXVI.—W. R., male, colored, aged forty-two, married, tailor. First seen Feb. 12, 1913.

Diagnosis.—Syphilitic arthritis.

Family History.—Wife had no miscarriages, not living together.

Previous History.—Did not have diseases of childhood. Thinks he had yellow fever when small. Had gonorrhea four years ago and once or twice before; developed chancre two months ago, just recovered from it. Had sore throat just after appearance of chancre, also rash. Whiskey two or three times a day, occasional beer.

Present Illness.—Has had pain in joints for three weeks, getting worse. Started in left ankle. Went to knees, then to right ankle, then to arms, shoulders, back of neck, now all joints are painful. Some days feels better. Pain worse at night.

Previous Examination.—Remnants of tonsils only. Nasopharynx, red. Cervical axillary inguinal and epitrochlear glands much enlarged. Body, covered with remnants of old, fading rash. Blood pressure 114. Arteries palpable, still has indurated scar, remnant of chancre. Joints, motions normal throughout, except spine which is rigid in lumbar region on forward bending. Sensitive point over fifth lumbar vertebra. Limitation of supination in left foot, whole astragalus sensitive to slight pressure, also lower end of internal malleolus. All joints are painful on motion. Wassermann, not made on account of definiteness of history and physical findings.

Subsequent History.—Patient was put on bichloride gr. 1/30 and potassium iodide gr. xv. On Feb. 14, the condition was somewhat improved. The treatment was increased in strength.

This case is given as an illustration of the acute toxic stage in early secondary syphilis.

TABLE I.—SUMMARY OF CASES ESPECIALLY STUDIED.

Number of cases	26
Male	13
Female	13
Married	14
Single	10
Widowed	2
White	16
Colored	10

DISTRIBUTION ACCORDING TO AGE.

Ages 1 to 10 years	2
Ages 11 to 20 years	2
Ages 21 to 30 years	4
Ages 31 to 40 years	12
Ages 41 to 50 years	5
Ages 50 to 60 years	1

BLOOD PRESSURE.

Highest	137
Lowest	95
Average	118

Positive Wassermann	20
Doubtful	4
Wassermann, not made	2

TABLE II.—OCCUPATIONS OF CASES REPORTED.

No injury to joint.

Case No.	Occupations	Joints involved
2	Laundress	Elbow and both knees.
3	Housework, cook and laundress	Hands, elbow and right knee.
4	Housework	General involvement, especially hands.
6	Cook and housework	Knees and ankles.
7	Laborer (stooping and lifting)	Back.
8	Bag factory and housework	Back and neck.
9	Cashier	Hands, ankles, general pain.
10	Waiter	General pain.
11	Seamstress (20 years age and housework.	Fingers, elbow, shoulders, knees.
12	Milliner	Hands and feet.
14	Accountant	Knee.
15	Teamster	Back.
16	Carpenter	Spine.
17	Laborer	Neck.
18	Child	Both knees.
19	Express driver	Back and ankles.
20	Housework	Knees, back and ankles.
23	Type-melter	Knees.
25	Housework	Knees, hands, ankles.
26	Tailor	General involvement.

TABLE III.—CASES REPORTED IN WHICH INJURY PRECEDED JOINT SYMPTOMS.

Case No.	Joint involved	Injury
1	Right knee	Fell on knees.
5	Neck	Fell and struck back of head.
15	Various joints	After getting wet.
21	Right ankle	Work constantly threw strain on this ankle.
22	Feet	Bartender, on feet 10 or 12 hours a day.
25	Right knee	Is constantly shifting gears with this leg.

TABLE IV.

Summary of *all Cases* of Joint Syphilis in Clinic from Jan. 1, 1912 to Feb. 17, 1913.

Number of patients seen in clinic	619
Total number diagnosed as syphilitic arthritis	64
Cases giving positive Wassermann	25
Cases diagnosed on symptoms without Wassermann	26
Cases, whose history suggests a diagnosis of syphilis	13
White patients	42
Colored patients	22
Male patients	40
Female patients	24
Married patients	33
Single patients	25
Widowed patients	6
Percentage of all cases diagnosed as syphilitic arthritis	10
Percentage giving positive Wassermann	3.8

DISTRIBUTION ACCORDING TO AGE.

1 to 10	3
11 to 20	3
21 to 30	13
31 to 40	20
41 to 50	15
51 to 60	9
61 to 70	1

TABLE V.

Occupations and Joints Involved, Cases of Syphilitic Arthritis from Jan 1, 1912 to Feb. 17, 1913 (not including Cases Reported).

Occupation	Joints involved
Laborer	Spine.
Lineman	Pain from hips down leg to knee and ankle.
Housewife	Elbow.
Saw filer	Spine.
Chauffeur	Back, neck, now knee and tibia.
Not working	Arm and knee, wrist, sternoclavicular joint.
Laborer	Joints and muscles.
Housewife	Knee.
Cook	Wrists.
Laundress	Ankles and periostitis of the tibia.
Housework	Lumbar spine.
Laborer	Spondylitis.
Teacher	Knee, hip, shoulder.
Laborer	Stiff, all over.
Housework	Knee.
Furniture business	Joints stiff, right shoulder.
Housework	Wrists, left tibia, ankle.
Housework	General involvement.
Shoe worker	Bones and back.
Laborer	Shoulder.
Restaurant	Wrist and knee.
Housework	General soreness.
Housework	Knee.
Hairdresser	Knee.
Marble worker	Hips.

TABLE VI.—INJURIES PRECEDING INVOLVEMENT.

(Not including cases reported.)

Joints involved	Injury or strain
Foot	Hit foot.
Knee	Seamstress, machine.
Wrist	Strained wrist wringing clothes.
Hip (right)	Hurt hip exercising.
Shoulder, elbow and wrist	Blacksmith.
Shoulder	Arm forced up with strain of shoulder.
Teno-synovitis	Shucked corn.
Right shoulder	Fell from haystack, hurting right shoulder.
Shoulder	Fell on shoulder.

TABLE VII.—JOINTS INVOLVED.

Cases Reported.

Spine		10
Shoulder	one	2
	both	0
Elbow	one	2
	both	0
Wrists	one	1
	both	3
Hands	one	0
	both	5
Hips	one	1
	both	0
Knees	one	6
	both	3
Ankles	one	2
	both	4
Feet	one	0
	both	3
General joint pain		5
Cases with single joint involvement		8
Cases with multiple joint involvement		18

TABLE VIII.—SYMPTOMS.

Cases Reported.

		No.
Pain	Severe	10
	Moderate	12
	Slight or absent	4
Motion	Free	6
	Slightly limited	12
	Limited	8
Swelling	Yes	14
	No	12
Time of pain	Day	15
	Night	11

In referring to Table I, it will be seen that the number is equally divided between male and female patients. Table IV, however, gives the number as male forty; female twenty-three. This is probably to be expected, because in making the ordinary record, a history of syphilis is more easily obtained in a man than in a woman. In our clinic the disease seems, according to Tables I and IV, to be by far the most common between the ages of thirty-one and forty. In most of the cases a definite history of the date of the primary infection was not obtained.

It is interesting to note that in no case reported was the blood pressure high, while the average was rather low. Arterosclerosis was not marked in any of the cases.

In Table IV, we see that 10 per cent. of all cases seen in the Clinic from January 1, 1912, to Feb. 17, 1913 were diagnosed as syphilitic arthritis or that on looking over the histories, their symptoms, viewed in the light of more careful investigation, pointed toward a syphilitic origin. The author feels that this is a very conservative estimate of the number of cases as only those giving a definite history of syphilis were selected, 3.8 per cent. of all cases seen during this period gave a positive Wassermann. This percentage is too low, for in a number of cases a Wassermann was not made, so that a number of positive cases are not included in this list, and there are probably a number of syphilitic cases which gave no history, and in which the disease was entirely overlooked. That syphilis was an etiological factor in the joint disturbance, and not an extraneous infection seems to be proved by the fact that the cases showed improvement when put on antisyphilitic treatment; and in all cases where this was given no other treatment was used. It would seem, therefore, that in the Washington University Hospital Clinic, at least, joint syphilis is much more common than has been heretofore supposed. Of the cases reported only two were congenital syphilis. This is explained by the fact that only adults as a rule attend this clinic. The joints most frequently involved (Table VII) are, on the whole, similar to the findings of other investigators. The author, however, has not seen any case of sterno-calvicular involvement, a condition reported by other writers to be quite frequent. The spine showed some involvement in ten cases. In the majority of these it was accompanied by more marked symptoms in other joints. The most striking fact in looking over this table and in reviewing the cases is that the great majority of cases showed a polyarticular condition. The monarticular cases were mainly in the knee. In many of the cases the symptoms jumped from one joint to another, before definitely settling in one or more joints. This seems to be a marked characteristic of joint syphilis.

Generally the symptoms were not severe (Table VIII). In this my findings correspond with those of other writers on the subject. As a rule, the most marked pain was found in those cases in which there was a general joint involvement of a toxic character. Functional disability was not proportionate to the amount of joint involvement. Pain at night was present in only eleven cases. This symptom is of value in confirming the diagnosis in doubtful cases, but its absence does not mean that the joint lesion is not syphilitic.

In reviewing Tables II and V, it would seem that there may be some relation between the occupation of the patient and the joint involved. When the occupation tends to put a special strain on certain joints, these joints seem to be more liable to involvement. This apparent relation between joint strain and injury and joint involvement is more strongly brought out in Tables III and VI. Of the cases reported in Table III, 23 per cent. gave a definite history of the joint lesion following directly on the injury, while in Table VI, it was 24 per cent. It would seem from this, that in the later stages of syphilis, the location of the lesion was dependent upon some joint strain or injury.

The author feels that a tentative diagnosis of syphilitic arthritis should be made in those cases in which the history is indefinite, and where a definite diagnosis of some other condition cannot be positively made.

The suggestive signs of joint syphilis seem to be an involvement of several joints at the same time or in rather rapid succession. This may later settle in one or more joints; as a rule, functional disability is not marked, in spite of considerable joint involvement. The pain is usually not great or much affected by motion. It may or it may not be worse at night. In the later stages night exacerbations seem less frequent than in the early and more acute stages. Indefinite joint pains are also very characteristic. Any one of these symptoms should arouse suspicion and a Wassermann should be made to aid in the diagnosis. The author, however, does not believe that a diagnosis of joint syphilis should be made unless the positive Wassermann findings have been confirmed by the therapeutic test. The diagnosis should be made on the symptoms and the Wassermann reaction aided and confirmed by the therapeutic test. No reliance can be placed on the history. The author has found that many patients deny any specific infection, either intentionally or because they are honestly not aware of its existence. Probably a large number of so-called soft sores an chancroids are of syphilitic origin. This conclusion has been reached by modern investigators since the use of the dark-field microscope. The author's experience, also, bears out this view.

I do not feel that I am justified in drawing any definite conclusions after a study of only twenty-six cases. These cases are not selected, except that the patient promised to return for treatment—a promise not always kept—but were taken as they came to the out-patient department. They represent fairly accurately the types which are met with constantly in the Clinic. I think it is, however, possible to draw some inferences which are accurate, at least for our clinic.

Syphilis of the joints is much more common than has been supposed, and the more general use of the Wassermnan reaction and the X-ray tends to show that a large number of cases supposed to be tuberculosis, osteoarthritis and infectious arthritis are really syphilitic in origin. A Wassermann test should be made in all cases of arthritis as a routine, and when positive the diagnosis should be confirmed by the therapeutic test. The absolute necessity of this is obvious, as the difference between the treatment of syphilis and the other conditions is so radical, that the prognosis depends essentially on the correctness of the diagnosis and the resulting treatment. All cases in which there is a history of indefinite joint tenderness, multiple joint involvement, pain, whether increased at night or not, or when the pain and functional disability are not proportionate with the amount of joint involvement, should be regarded with suspicion. In all cases, in fact, when there is any doubt as to the diagnosis, syphilis should be looked for.

Note.—The Wassermann reaction in these cases was made at the laboratory at the Washington University Hospital, and I wish to express my thanks to Dr. Nicholson and Dr. Deriveaux for their assistance in this work.

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CLINICAL DEPARTMENT.

XXXIV.

PLASTER-OF-PARIS INSTRUMENTS.

WILLIAM JACKSON MERRILL, PHILADELPHIA, PA.

Assistant Orthopedic Surgeon, University of Pennsylvania.

In the employment of plaster of Paris in orthopedic surgery, one usually has his own methods and instruments which to him, as a rule, serve his purpose far better than the devices of other men. The writer has devised the instruments shown in cuts and presents them for consideration. Fig. A, Plate I, represents a cast cutter of the punch type. The cutting blade 1 engages with slot 3, and cuts from the front backward. The segment 3/16 inch wide by 1/2 inch long is forced out through the slot. Thickness from 0 inch to depth of the hinged guard 2 can be cut with comparative ease. Fig. B, Plate I, represents a plaster forceps for the spreading of casts, for lifting edges too near the skin, and for facilitating the removal of casts. Blade 2 is about 1/2 inch wide and engages with blade 1 for gripping. Blade 1 is about 1 inch wide at mid point; both have serrated surfaces. The curve of the blades gives a powerful leverage to the force applied to the handles.

Dr. H. Augustus Wilson devised a form of plaster tongues which had parrot-bill blades. The upper angular and the lower practically straight. Fig. C, Plate I, represents a knife with removable blades. The blades have a rounded blunt point, with a cutting edge E–E′ some distance from point which lessens the possibility of cutting the patient and does not diminish the utility of the knife. The elevator point 2 is useful in prying upward, or open, the edges cut, and is useful in rounding off the sharp edge of the cast near the skin.

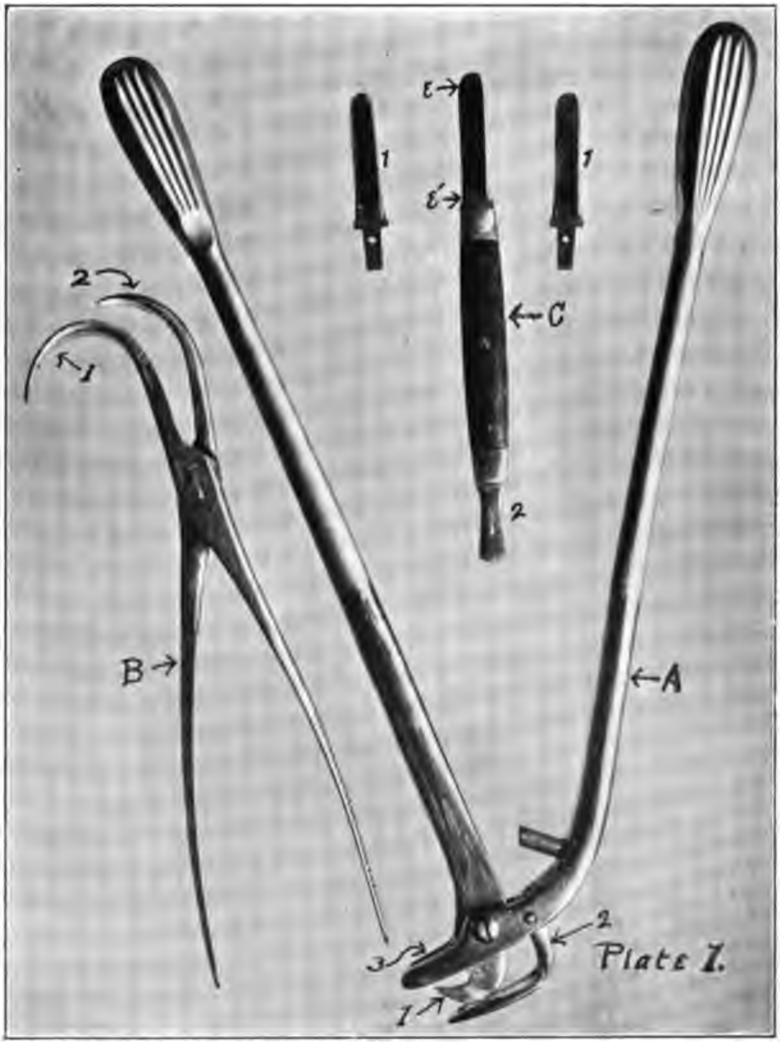

Plate 1.

XXXV.

MALFORMATION OF THE LAST LUMBAR VERTEBRA IN A GORILLA.

BY JOEL E. GOLDTHWAIT, M. D., F. A. C. S.

In an article entitled, "An Anatomic Explanation of Many of the Cases of Weak or Painful Backs, as Well as Many of the Leg Paralyses," published in the *Boston Medical Journal*, January 23, 1913, attention was called to the frequent malformations of the low spine and sacrum as seen in the human family.

The present communication is made simply to report a similar finding in the skeleton of a gorilla (Fig. 1) which hangs in the Natural History Museum in Boston. Through the courtesy of the Curator, Mr. Johnson, the accompanying photograph has been taken, and shows the complete sacralization of the last lumbar vertebra upon the left side, with the broad transverse process upon the right side, but not fused with the sacrum. In this instance it is undoubtedly the last lumbar vertebra which has become partially sacralized rather than the first sacral vertebra in which the change had taken place.

Another illustration is also of interest, since in the same collection is a skeleton (Fig. 2) labelled "An Hawaiian Woman," showing the malformation of the last lumbar vertebra with a lumbo sacral transverse articulation upon the right side and with a broad transverse process upon the left, under which there must have been a bursa.

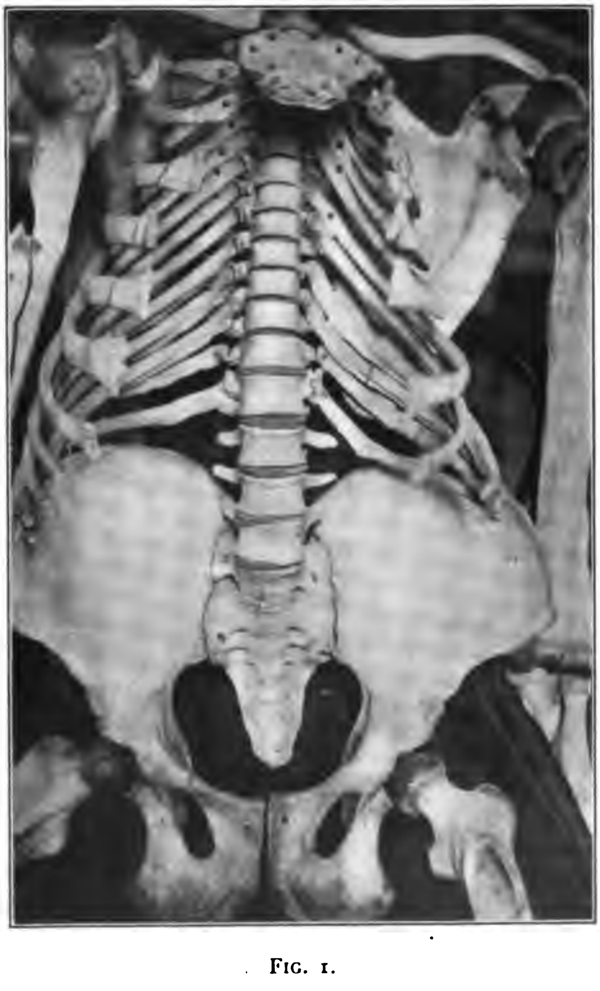

FIG. 1.

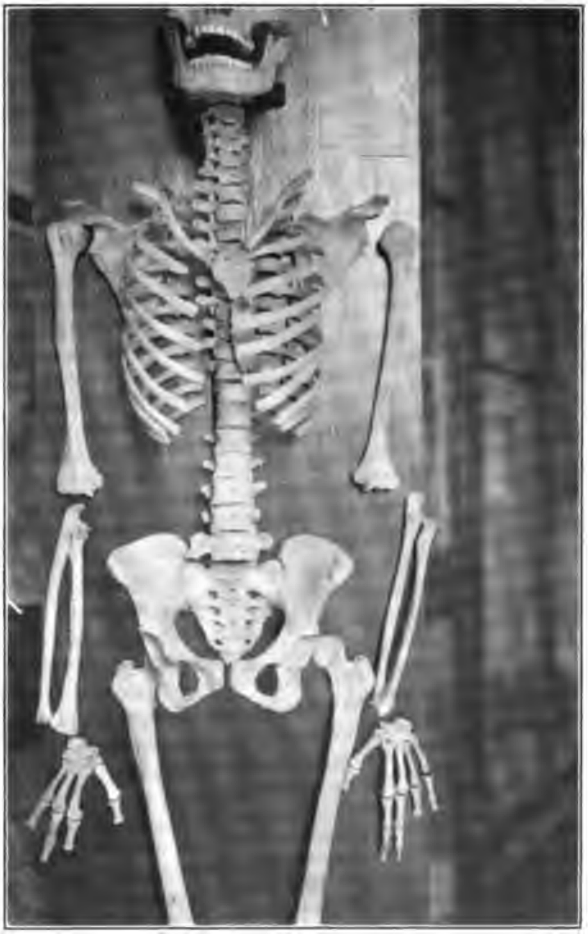

FIG. 2.—

REPORTS OF SOCIETIES.

TWENTY-SIXTH CONGRESS OF THE FRENCH SURGICAL ASSOCIATION.

Paris, Oct. 6–11, 1913.

Translation of the Résumé furnished by Dr. Jacques Calvé (*Berck*).

Treatment of Ankyloses by the Open Method.—Contributors: A. Baumgartner (Paris) and Denucé (Bordeaux). The long discussion which followed these two communications added nothing new to what was said on the same subject at the International Congress at London, Aug., 1913. Discussed by Tubby (London) and Putti (Bologna), guests of the Congress, and by Judet, Savariand, Campenon (Paris), Boeckel (Strassburg), Roux (Lausanne), Delagenière (Mans), Nové-Josserand (Lyons), etc.

One may conclude that certain new methods are destined to have a great future but are too recent to have secured this, as yet. "The Congress expected to witness the baptism of a new operation; the discussion failed to adduce proofs sufficiently convincing; the baptism therefore is hopefully postponed" (Roux, of Lausanne).

Fractures of the Elbow in Infancy.—Silhol (Marseilles). In the infant, fractures of the elbow may be reduced under anesthesia; but in general, the end result is not brilliant. The author, therefore, favors operative intervention, which he has employed in forty-seven cases with encouraging results. That which blocks the joint is the external condyle, displaced or augmented in size; it is of prime importance to remove this. Mere reshaping of the condyle is of no avail. Cases operated upon after this manner show at a later date the reformation of a very small external condyle. The interposition of muscular tissue is not required.

Radiography in the Study of Successive Stages of Tuberculous Osteitis and Osteoarthritis.—Ménard (Berck). In radiographic plates, one learns quickly to distinguish foci of tuberculous osteitis of recent date—ill-defined dark areas with subperiosteal hyperostosis in clear tint—from old foci whose clear centers, with or without the shaded image of an enclosed sequestrum, are outlined by a sharply defined dark border.

Excepting in rare instances, surgical intervention is justified only when the lesion has assumed the appearances characteristic of chronicity.

In the study of coxalgia, type of tuberculous osteoarthritis, the radiograph serves at once to eliminate, in the matter of diagnosis, the non-tuberculous arthritides, *e.g.*, juvenile arthritis deformans (of the German authors), coxa vara (Calvé), that appear in hips already the subject of some particular osteogenetic disturbance, which Ménard attributes not to infections but rather to congenital origin; likewise, the pains which mark the onset of coxa vara of the ordinary type.

It serves also to separate out the rather rare cases of juxtaarticular tuberculosis (femoral neck, pubis, ischium).

In the course of the ordinary, eroding, form of coxalgia, it shows the successive stages of the process: first, the slight outward displacement of the femoral head, decalcification; at the end of the first year, thinning of cartilage, marked decalcification with alteration of the surface outlines; second year, erosion (*ulceration*) of the head and acetabulum to the extent of 5, 10, 20 mm. and corresponding ascension of the femur; third year, delimitation of the eroded surfaces by an increasingly distinct dark border.

Again, radiography forecasts and finally demonstrates the evolution of the osteoarticular lesion: ankylosis with or without hyperostosis, pseudarthrosis, luxation with or without ankylosis.

Treatment of Scoliosis by Abbott's Method.—Calvé (Berck) and Lamy (Paris), although promoters in France of the method of Abbott, were unwilling to subscribe to it without reservation until after a long clinical and experimental study thereof.

They proposed to investigate these three points: (1) Is it effectual? (2) Is it harmful? (3) Is it applicable to all cases?

After a critical study of their results, aided by photographs and radiographs, which are often inconclusive or deceptive, they undertook the making of serial casts (of over thirty patients), then they sectioned these casts to compare them in different stages of treatment. Here are the results of these investigations, demonstrated by the aid of projections.

The method is effectual, for it compels the expansion of the primarily atrophied parts, at the same time that it causes a rearrangement of the respective thoracic segments.

It is not injurious, for not only is the respiratory system considerably benefited, as abundantly proven by numerous spirometric tests systematically applied to all the patients, but also the general condition is markedly improved.

Finally, although the method should not be applied indiscriminately to all cases, it appears to fulfill nearly all the requirements.

Thus the authors conclude that "this method places at our command a measure of really extraordinary efficiency, which, in the majority of cases may be applied without fear, with the greatest hopes of success, to those who entrust themselves to us."

Mencière (Rheims) is a partisan of Abbott's method: Spine flexed to untwist the vertebræ; but for correcting the thorax he insists particularly upon the rôle played by respiration, as utilized by his device (*automodeleur*) for enforcing respiratory exercise by means of pneumatic pressure applied dorsally under the passive corrective apparatus (1909). He believes that the principle of "the flexed spine" combined with that of the *automodeleur* is destined to change the prognosis of scoliosis. But, contrary to the technic of Abbott, instead of placing the patient in dorsal decubitus on a hammock he causes his subject to sit, the trunk inclined forward, supported by a band, in abdominal decubitus, the forearms upon a stand, reproducing in inverse manner the etiological conditions of the school-desk scoliosis. The advantage of this position is that it affords the maximum of untwisting (*détorsion*) while permitting the rapid application of the apparatus.

Lance (Paris).—More difficult in the adult, almost impossible of application in the case of young children, the method has its maximum efficiency at the ages of fourteen to twenty years. Good results are obtained in total, dorsal, and single-curved lumbar scolioses. Scolioses with a double curve are corrected with much greater difficulty. Rickets in its active stage is a contraindication to the use of this method. The coexistence of certain malformations of the thorax (funnel-chest, etc.) also contraindicate it. For some cases with extreme bony deformity it is ineffectual. It should be formally forbidden in all cases where there is a suspicion of pulmonary tuberculosis. Recent cardiac insufficiency, however, induced by scoliosis, is favorably influenced by the *redressement.*

The method is efficacious particularly as to rotation of the vertebræ and ribs. The author showed some photographs and radiographs which demonstrate this action.

Complete correction of the lateral curve can be obtained only when the vertebral deformities are slight. In cases with marked deformity a slight degree of lateral curvature persists.

But on the whole, as shown by the series of casts exhibited by the author in the *salle du Congrès*, the results are very encouraging.

Calot (Berck) finds the prognosis and the treatment of scoliosis entirely altered by Abbott's method. "Until now we did not know how to cure scoliosis and we were not even sure of arresting its progress. We can now promise a cure in cases not too far advanced (fourth degree), for the nature of the scoliosis is no longer a contraindication, nor is the age of the patient entirely so. It is only the extreme degree of the scoliosis that constitutes a contraindication or rather that renders impossible a complete result, for even in these cases one may obtain appreciable ameliorations.

Spontaneous Supracondylar Fractures during the Period of Discontinuance of Treatment of Congenital Dislocations of the Hip reduced by the Bloodless Method.—Codet-Boisse (Bordeaux) in 117 patients treated for congenital dislocation of the hip has seven times observed fractures of the femur several centimeters above the lower epiphyseal cartilage.

They occur during the days or weeks following the removal of the last apparatus, either spontaneously without appreciable traumatism, or after an insignificant traumatism (massage, lifting of the child, etc.). They appear to result from a decalcification of bone.

If recognized, the prognosis is good; they are repaired after three to five weeks of continuous extension, without affecting the anatomical or functional result of the treatment of the dislocation.

They deserve to be noted because: (1) they are not exceptional; (2) they may not be recognized unless one is advised of their possibility; (3) they point the necessity for great care in the handling and in the postoperative care of the children; they render imperative prolonged medical observation of children thus treated for congenital dislocation; (4) finally, and above all, they bear witness to a certain decalcifying action due to the use of a closed plaster apparatus, entirely apart from any bone dystrophy such as in rickets, tuberculosis, etc.

P. Redard (Paris). Supracondylar fractures of the femur after bloodless reductions of congenitally dislocated hips are certainly quite frequent. They may occur immediately after the removal of the last cast, or much later, when walking, after a fall, or after a slight blow.

Two varieties must be distinguished: (1) fracture in the lower third of the femur, subperiosteal, simple bowing of the bone, without displacement, healing with ordinary treatment; (2) epiphyseal separation with displacement of the fragments, often marked, having a grave prognosis because of the difficulties of reduction and retention.

Among the chief causes of these fractures one must note particularly trophic disturbances, bone decalcification, due to operative trauma and to prolonged immobilization in plaster. Hence the indication for reducing to as short a time as possible the period of immobilization.

Treatment of Congenital Club-foot by the So-called Subcutaneous Gouging (Evidement).—L. Lamy (Paris) advocates this method which he has systematically applied for four years in all irreducible cases of club-foot. It is applicable to all young children on account of its mildness, and up to the eighth year, for, as the author's researches show, up to this age the astragalus retains a cartilaginous shell which is sufficient to ensure a perfect regeneration of the bone, as proven by radiographs.

One may thus sum up the advantages of this operation: Simplicity of the intervention, both instrumental and manual; absolute harmlessness, no shock, no hemorrhage, chances of infection reduced to a minimum; remarkable results combining happily all the advantages of the other methods, bony and ligamentous, without their inconveniences; conservation of the articular surfaces and of motions; no shortening of the foot; finally and particularly, permitting of a direct attack on the principal factors, *i.e.*, on the skeletal structures, this method ensures a perfect correction.

Insufficiency of the Hip (l'insuffisance de la hauche).—Gourdon (Bordeaux). There are certain slight, congenital malformations of the hip, not inducing luxation, but manifesting themselves by certain symptoms which have not hitherto been described but which it is important to recognize, for they may be misinterpreted and cause errors in diagnosis, as of rheumatism, growing-pains, etc.

The malformations generally appertain to the acetabular cavity which is shallow, expanded in height and vertical in direction; at times the upper end of the femur itself is deformed, the neck is shortened and curves forward.

These malformations cause a defective apposition of the coxofemoral articular surfaces, they afford an incomplete mutual support, there is an "insufficiency" of the hip.

The symptoms are: habitual sensation of fatigue in the leg when walking, pains about the knee and especially in the groin, more rarely in the hip. No claudication, but, in cases in which a slight displacement of the femur occurs, an unnatural gait with the weight borne more on the sound limb. The symptoms appear tardily at ten, fifteen, twenty and even twenty-five years.

Examination reveals nothing in particular, except, occasionally in the more marked cases, a restriction of abduction.

Treatment consists in active exercise in abduction of the leg, and the wearing of a canvas corset encircling the hips. When there is a displacement of the femur, it is necessary to tenotomize the abductors (?) and maintain the thigh in extreme abduction for two months; after this gymnastic treatment should be instituted as for the milder cases.

INTERURBAN CLUB.

Montreal Meeting, Nov. 28 *and* 29, 1913.

Friday, Nov. 28, 1913.

1. Dr. Forbes showed two cases of infantile paralysis treated by the Bartow-Plummer method of interarticular ligaments. One was a case of complete paralysis of quadriceps extensor on one leg, and marked, though not complete, paralysis on the other leg. The child, a boy of six or seven

femoral neck fracture in a young woman. There was no notable limp and the functional result was perfectly satisfactory.

Dr. Gruner's studies in bone marrow had evidently been very extensive, but were too involved to permit of a satisfactory report.

Dr. W. G. Turner demonstrated the use of his apparatus for overcoming knee-joint flexure and showed a case in which extreme deformity of this sort due to a cord lesion had been successfully overcome. He exhibited two cases of polyarthritis, one with associated tuberculosis giving rise to the suspicion that the articular lesions, though polyarticular, were tuberculous; the other case was associated with constipation, undoubtedly due to a "Lane's kink." The articular symptoms had been much benefited by treatment directed toward the relief of the intestinal condition.

Dr. Nagle, the anesthetist of the hospital, discussed some of the newer technic in anesthesia.

Dr. Maud Abbott gave a most interesting demonstration of the uses made of the pathological material in the Museum and described the system of cataloguing the specimens on the shelves and in storage. The material available for teaching purposes is large and admirably arranged. The employment of it for demonstrations to small sections of students renders the teaching of clinical medicine much more comprehensive.

Drs. Archibald and Von Eberts showed the surgical laboratory and described some of the problems that they were seeking the solution of, their studies being carried on in that laboratory.

The meeting was very fittingly closed by a most interesting talk by Prof. Adami on autoinfections or toxemias, reviewing with some detail the work which has been done on the subject, attempting to give it its true value so far as it is possible to determine it in the light of our present-day knowledge.

CENTRAL STATES ORTHOPEDIC CLUB.

Meeting at Lincoln and Omaha, Nebraska, Nov. 8, 1913.

The third meeting of the Central States Orthopedic Club was held in Lincoln and Omaha November 8, 1913.

The Nebraska Orthopedic Hospital was first inspected by the entire party. Following this there was a fifteen minute stereopticon exhibition by Dr. Orr, illustrating departments, patients and methods at the institution. Dr. H. H. Everett was introduced and gave a talk on Local Anesthetic Methods especially as applied to surgery of the extremities.

Dr. Lord presented a series of miscellaneous surgical cases illustrating methods of treatment in bone and joint tuberculosis, congenital deformities and paralytic deformities.

Dr. Orr presented eighteen cases under treatment by the Abbott method for the correction of scoliosis and demonstrated a new method of applying the corrective bandages in the Abbott frame. He also presented three patients with cured flat-foot after tenotomy of the peronei, and one of corrected talipes equinus in which there had been resection of the astragalus and of half of the second to fifth metatarsals.

The entire party was escorted to the St. Elizabeth Hospital by Dr. A. I. McKinnon of Lincoln who showed them the institution and presented a case of dislocation of the patella cured by operation.

Upon arrival in Omaha at 3.45 the party was taken to the St Joseph's Hospital. Dr. C. C. Allison had a patient on the table with ununited fracture of the neck of the femur. He demonstrated an apparatus devised by one of his assistants for maintaining the extremity in traction during open operation and drilled and nailed the head of the femur in position. The X-ray department was visited and short talks given by Dr. Lord and Dr. A. F. Tyler.

The party next visited the recently completed laboratory building of the University of Nebraska College of Medicine.

At the Methodist Hospital, Dr. A. F. Jonas presented patients and X-ray pictures illustrating methods of bone grafting and other procedures for securing union in ununited and compound fractures.

At the Clarkson Hospital which was visited next, Dr. Lord presented three patients: one with rheumatoid arthritis, one with obstetric paralysis and one with dislocation of the cranium on the atlas, the result of a birth injury. Dr. J. E. Summers was introduced and spoke on orthopedic support for visceral ptosis and on the embryologic and anatomic considerations in connection with the so-called Jackson Membrane.

ABSTRACTS

I. TUBERCULOUS LESIONS OF BONES, JOINTS AND TENDONS. GENERAL ARTICLES ON TUBERCULOSIS.

Etiology of Bone and Joint Tuberculosis. By B. Möllers. *Deut. medizin. Wochen.*, Sept. 18, 1913, p. 1826.

This article is the result of investigations in twelve cases to determine the occurrence of the human or the bovine type of bacillus in tuberculous lesions. The author agrees with many other writers that the human type is nearly always found and disagrees with Fraser of Edinburgh, who found the bovine type in nearly two-thirds of the cases examined by him. —*Roland Hammond, M. D., Providence, R. I.*

Treatment of Surgical Tuberculosis by Artificial Light. By Richard Hagemann. *Deut. medizin. Wochen.*, July 24, 1913, p. 1450.

Many articles are appearing in the literature of late, dealing with sunlight treatment of surgical tuberculosis. The unfavorable climate of lower Germany with little sunshine made it necessary to resort to artificial light. Hagemann has employed the technic of Rollier in the sunlight treatment, substituting the light from quartz lamps. The results compare favorably with those obtained in Switzerland. The author believes the red rays are a powerful factor in the sun treatment, and thinks the value of the ultra-violet rays has been overestimated. Another factor of importance is exposure of the body to the air, even if the sun is not shining.—*Roland Hammond, M. D., Providence, R. I.*

Experiences with Roentgentherapy in Bone and Joint Tuberculosis. By E. A. Oppenheim. *Berlin. klin. Wochen.*, Aug. 4, 1913, p. 1433.

The author was unable to employ heliotherapy to advantage in the lowlands, and therefore restored to roentgentherapy. He reports twenty-one cases, showing, on the whole, good results.—*Roland Hammond, M.D., Providence, R. I.*

Sun and Air Treatment of Surgical Tuberculosis. By Paul Glaessner. *Berlin. klin. Wochen.*, Aug. 4, 1913, p. 1434.

Experiences at a sanatorium located at a mid-elevation are given. In general the technic of Rollier (serial exposure of the body) was followed. The author regards heliotherapy as a powerful factor in the treatment of surgical tuberculosis, especially in children.—*Roland Hammond, M. D., Providence, R. I.*

The Fresh Air and Sunshine Treatment of Bone Tuberculosis. By Kofmann. *Zeitschr. f. orth. Chir.*, Bd. XXXII, p. 444.

For ten years the author has been employing this method of treatment with gratifying results. He has established a sanatorium on the shore of the Black Sea. His patients are placed naked in the sunshine in the open air for short periods until they gradually become accustomed to the exposure and the heat. Sinuses and ulcerated wounds are exposed uncovered to the sun's rays. Recent sinuses close quickly while older ones require longer time to heal. A striking result of this method of treatment is the frequent cure of the joint disease with mobility of the joint instead of the usual and desired ankylosis secured by former methods.

Kofmann thinks that it is not always necessary to place these cases of surgical tuberculosis in sanatoria in the mountains or by the sea, but that the fresh air and sunshine will work a cure anywhere, although it is better to remove the child from the city. If we take our cases early, remove them from the city, expose them to the working of Nature's remedies, then most of these children will grow well and strong and come to normal adult life without deformity.—*A. Bruce Gill, Philadelphia.*

Physiotherapy of Diseases of the Joints and Particularly of Tuberculosis.

By Wilms. *Zeitschr. f. orth. Chir.*, Bd. XXXII, p. 321.

The author considers first the use of the X-rays and of radium and thorium in the treatment of acute and of chronic joint-rheumatism; and second, the Roentgentherapy of tuberculosis.

While the beneficial influence of the X-rays upon gout, rheumatism, and arthritis deformans has been remarked by numerous writers since Sokolow's observations in 1897, a new interest has been recently aroused in this subject and more especially in the use of radium in the form of radium-impregnated waters and of radium emanations. His, Gudzent, and von Noorden have been leaders in this movement and have recorded excellent results. Von Noorden and Falta recommend the use of radium waters first until improvement appears to cease, and then the continued use of radium emanations. The prognosis is better in the exudative form of chronic joint rheumatism than in the dry form. Contraindications to the use of radium are endocarditis, heart weakness, severe neurasthenia, old age, tendency to hemorrhages, and tuberculosis of the lungs. Good results have also been obtained in acute rheumatism. The use of thorium subcutaneously or intravenously has given similar results.

Kirmisson in 1898 was the first to employ the Roentgen rays in the treatment of joint and bone tuberculosis. He, with other succeeding authors, reported a number of cases cured by this treatment. More recently Iselin has perfected a technic which gives much better results. The Roentgen rays are applied in very large dosage to the affected area on four sides through aluminium filters and at intervals of three weeks. The author gives full statistics from his clinic and from Iselin's showing the various conditions treated and the highly satisfactory percentage of cures. Other methods of treating the tuberculous disease are to be employed in conjunction with the roentgentherapy.—*A. Bruce Gill, Philadelphia.*

The Sunshine Treatment of Tuberculosis of Bones and Joints.

By Rollier. *Zeitschr. f. othr. Chir.*, Bd. XXXII, p. 337.

After an experience of ten years with heliotherapy at the high altitude of Leysin in the Alps Rollier confidently states that all cases of external, or surgical, tuberculosis, even the most severe, can be cured.

External tuberculosis must not be considered as a local disease demanding only local treatment. It is a general infection involving the entire body, and all the forces of the entire body must be enlisted in the struggle to overcome the invading infection. The influence of the sun and air in contact with the entire surface of the body acts as an energetic tonic, while the sun's rays locally exert a direct influence in allaying the swelling and pain and in curing the focus of the disease. The author condemns the use of plaster casts or similar appliances because they keep the light and air from the skin and produce anemia and atrophy of the parts thus imprisoned.

Rollier's method of handling his cases is as follows: Each case is treated individually. After the child's arrival at the sanatorium it spends a few days in bed in a room to become accustomed to the altitude and to the mountain air. Then the bed is wheeled out upon the gallery where the child has free exposure to the sun and the air. The child is clothed in white cloth or in flannels and the head is protected by a shade and the eyes by glasses against the brilliance of the sun. The time of the exposure is short at first but is gradually increased. Then a small part of the body, as the feet, is exposed naked to the sun's rays for a very short time. Gradually more and more of the body is exposed for longer periods until finally the child can live naked, as it were, in the open air both summer and winter. Care is taken to avoid blistering the skin by too rapid exposure to the sun. Gradually the skin of the entire body becomes darker and darker until it is a copper color or a chocolate brown. The progress in the healing of the disease seems in a measure proportionate to the pigmentation of the skin.

In addition to this general treatment by exposure to the sun and air Rollier employs methods to cure the local deformity. Cases of tuberculous spondylitis are treated by long-continued and strict immobilization in the horizontal position both in the dorsal and the abdominal positions. When the patient lies on the back, firm pads are placed beneath the kyphus; when he lies on the abdomen, the buttocks are fastened to the bed and the upper part of the body is elevated to produce extension of the spine. In cervical spondylitis extension is applied to the head. Tuberculosis of the hip is treated by immobilization on a firm level bed and extension applied to the foot. Lateral weight extension is applied above the knee in cases of adduction deformity.

By these methods Rollier secures complete reduction of deformities even when very marked. His article is well illustrated to show his methods and to show cases in whom complete cure of the disease and the deformity has been secured. One marked feature of his results is the preservation very often of the normal mobility of the affected joint.

Heliotherapy has been found useful in other forms of tuberculosis as well, such so adenitis, peritonitis, and tuberculous disease of the male and female urogenital organs.—*A. Bruce Gill, Philadelphia.*

The Treatment of Tuberculosis of Bones and Joints at Berck by the Sea.

By Ménard. *Zeitschr. f. orth. Chir.*, Bd. XXXII, p. 372.

One of the chief factors in the treatment of bone and joint tuberculosis in Berck is the fact that the patients spend a large part of the day on the seashore. Those who cannot walk are brought in carts and chairs and wagons. The Maritime Hospital, which has 1060 beds, has open porches, or terraces, that hold 516 beds. Similar terraces are provided at all the institutions and sanatoria of Berck and afford accommodations for the sea-air treatment of almost all the patients in Berck. The author believes that the meteorological conditions in this town by the sea are most favorable for the treatment of the sick.

Patients newly arrived in Berck cannot spend much time on the shore without feeling some ill effects. They must slowly and gradually become acclimated until they are able to pass the entire day in the open, and even to be exposed naked to the sun's rays. Sea baths are employed for certain patients, such as those who have tuberculous glands or rachitis.

The author employs also the well-recognized principles of the local treatment of surgical tuberculosis to secure healing and to prevent or to cure deformity, but he maintains the opinion that the general treatment by exposure to the sun and air of the seashore at Berck is a great aid in securing good results.—*A. Bruce Gill, Philadelphia.*

II. PARALYTIC DISEASES AND THEIR DEFORMITIES. NERVE LESIONS WITH ARTHROPATHIES.

Generalized Postdiphtheritic Paralysis. By Duncker. *Arch. f. Orthop., Mech., u. Unfallchir.*, Bd. XII., H. 3.

The universal use of antitoxine has hardly decreased the number of cases of postdiphtheritic paralysis nor lessened the severity of the symptoms. The paralysis may come on weeks after the active inflammatory process in the throat seems cured, and is possibly due to the infection still being alive in the throat.

Duncker describes a most interesting case of generalized postdiphtheritic paralysis occurring in a young girl in whose throat a few living diphtheria bacilli were still found twelve weeks after the patient had received 8,000 units of antitoxine, and on the twelfth day, a paralysis of the throat was manifest. Week after week the paralysis of the eye, neck, back and trunk muscles progressed until there was almost a universal muscle paralysis. The brain was also gravely afflicted so that the author can rightfully claim that this case is one of the most severe postdiphtheritic afflictions on record. The treatment given was large doses of antitoxine and local and general treatment for the muscle paralysis. The patient slowly recovered.

An excellent review of the subject is given in this article. The author claims that antitoxine in big doses given early to be the best therapeutic measure for combating the poisoning of the central and peripheral nervous system.—*Walter G. Stern, Cleveland.*

The Mode of Transmission of Poliomyelitis. By M. J. Rosenau. *Boston Med. and Surg. Journal.*, Vol. CLXIX, No. 10, Sept. 4, 1913.

The author in an interesting paper speaks of the chief theories in regard to the spread of poliomyelitis, namely: (1) That it is a "contagious" disease, communicated directly from person to person, through the secretions from the mouth and nose; (2) that it is an insect-borne disease; (3) that it is conveyed through dust; (4) that it is an alimentary infection. He states that there is evidence from the laboratory and field reports to support each one of these theories. He reviews these various theories with the arguments for and against their acceptance and calls attention to the seasonal prevalence of this infection which corresponds more closely with that of the insect-borne diseases than that of any other group, in that it occurs in all parts of the world largely during the summer and early fall months. He also calls attention to its epidemic occurrence in rural rather than in urban communities. He believes that as a result of intestinal infection it has not been given the consideration it deserves and notes that monkeys may be infected by feeding, and that the virus may be found in the intestinal mucosa and feces. He states that all attempts to transmit poliomyelitis to lower animals, except monkeys, have failed. He states that poliomyelitis does not have the characteristics of a dust-borne disease and that this theory has been given slight credence. No conclusions are offered in this interesting paper—but it is well worth reading.—*James Warren Sever, Boston.*

The Late Results of Joint Pegging. By *Arch. f. Orthop., Mech., u. Unfallchir.*, Bd. XII., H. 4.

In 1908 Lexer proposed to ankylose paralyzed joints by pegging the bones forming the joint with a pencil of bone with its periosteum attached. In place of such a living graft, pegs were also taken from the bones of cadavers and used after sterilization by boiling. In 1910, Peter Bade proposed the use of ivory pegs, and this operation was performed fourteen times by Gangele at the Home for Cripples in Zwickau. Two and one-half years afterward the cases were re-examined with the following results. In a boy of four years, one peg which was driven into the ankle-joint was still intact. On the other side, a similar peg had loosened and gone up further into the tibia so that the fixation between the os calcis and the astragalus was lost. In all other cases, the ivory peg had broken. It was always a clean break across the long axis, at the level of the joint surfaces. It was never splintered.—*Walter G. Stern, Cleveland.*

The End Results of Operative Treatment in Thirty-three Cases of Spastic Paralysis. By Herbert E. Harris, Providence, R. I. *Boston Med. and Surg. Jr.*, Vol. CLXIX, No. 3, July 17, 1913.

The author concludes that in the cases studied that subcutaneous tenotomy was an adequate and safe procedure instead of using an open incision to lengthen a tendon. In none of the cases observed was there permanent or undesirable lengthening of the tendon after tenotomy.

Alcoholic injection of nerve trunks did not prevent eventual return of spastic contractures, and much is to be expected from the Tubby operation of transferring the pronator radii teres to work as a supinator. Careful after-treatment and long-continued use of plaster of Paris and splints are essential to the success of any operative procedure.—*James Warren Sever, Boston.*

Tabetic Arthropathia. By Max Krueger. *Mitteil. aus den Grenzgeb. der Medizin u. Chirurgie*, Vol. XXIV, p. 109.

Arthropathia is frequently the first and sole symptom of tabes and is therefore at times not recognized, and confused with tumor, tuberculosis or rheumatism. The onset is frequently rather sudden and a grave destruction and new formation of bone may take place rapidly, followed by relaxation of the joint mechanism. or spontaneous dislocation. The first symptom is often a painless synovitis caused by a sanguinolent exudate. Krueger describes a case where the X-ray showed ulcerations of the tibia which were demonstrated by the autopsy made on the amputated leg. Similar ulcers were found on the other knee without further symptoms. Occasionally a small atypical joint fracture is followed by a tabetic arthropathia. Nonne's reaction has been found of great diagnostic value. It was positive in all cases while Wassermann's reaction was frequently negative. Nonne's reaction is taken in the following way: One cubic centimeter of the liquor cerebrospinalis is mixed with 1 c.c. of concentrated solution of ammonium sulphuricum. The reaction is positive if an opalescence takes place, it is strongly positive in case of a cloudiness. Nonne's reaction is of a special importance in the diagnosis of early cases.

Therapy: Antispecific treatment is advisable. Most important is sufficient support by a Hessing apparatus. Resection does not give good results due to the tendency to infections and poor formation of callus. Operations in question are amputations and osteoplastic amputations such as Pirogoff's and Gritti's operations.

Etiology: Krueger discusses Charcot's theory of nervous etiology and Volkmann's and Virchow's traumatic theory and considers the latter as having more probability, because he has found at times small pieces of bones torn off as well as hemorrhagic exudates. Against the trophoneurotic theory speaks especially the fact that the bones usually do not show any atrophy. As to early causes several factors may come under consideration such as traumata, gummata or luetic periostitis. For the further progress of the disease the old mechanical theory is still in place.—*C. H. Buchloz, Boston.*

New Point of View in Tendon Transplantation. By A. Stoffel and E. Stoffel. *Deut. medizin. Wochen.*, Aug. 28, 1913, p. 1680.

The authors have recently performed tendon transplantation with a new idea of muscle function in mind. No muscle should be used as a substitute for the paralyzed muscle, except one having a similar function. The individual power and function of each muscle must be considered. Muscles must be so transplanted that they will work to the best mechanical advantage, and in the same general direction as the paralyzed muscle. The muscle should be given its normal physiological length, but stretching must be avoided. They always transplant to periosteum. In addition they test a muscle during operation with an electric needle to determine its strength.—*Roland Hammond, M. D., Providence, R. I.*

Infantile Paralysis Affecting the Lower Extremities, its Surgical Treatment and Possibilities of Cure. By E. Magruder, M. D., Washington, D. C. *J. A. M. A.*, Nov. 8, 1913.

One case is reported in which the biceps tendon was transplanted into the patella, and a double fixation of the ankle-joint was made with three screws, the after-treatment was very carefully carried out and the result was good.—*Edward S. Hatch, New Orleans.*

The Surgery of Infantile Paralysis. By Edwin W. Ryerson, M. D., Chicago. *J. A. M. A.*, Nov. 1, 1913.

This paper is confined to paralysis of the lower extremities, in the early stages care should be taken that the feet and legs are kept in good position, that is, feet at right angles to the legs, etc.

When necessary the tendon Achilles should be lengthened by the step operation, in severe knee contractures it may be necessary to shorten the femur.

The technic of the operations for tendon transplantation and silk ligaments are well described. The author discourages the use of nerve transplantations.—*Edward S. Hatch, New Orleans.*

Limitations of Lange's Silk Ligaments in Paralytic Surgery, and Substitutes therefor. By Edward A. Rich, M. D., Tacoma, Washington. *J. A. M. A.*, Nov. 1, 1913.

The silk ligament is a useful measure in joints not subjected to the greatest strain or to external irritation. Capsule tucking is used in place of ligaments especially in the foot, together with tendon work, and it does well.—*Edward S. Hatch, New Orleans.*

A New Method of Operative Treatment of Ischemic Contracture. By Dr. Alfred Horwitz. *Deutsche Zeitschrift für Chirurgie*, Bd. CXXI, Heft 5–6.

The method consists in removal of the first row of carpal bones in selected cases.—*Alexander Colvin, St. Paul.*

III. Metabolic Disturbances Causing Bone and Joint Diseases. Infectious Arthritis, Osteomyelitis, Etc.

The Treatment of Arthritis Deformans. By Wollenberg. *Zeitschr. f. orth. Chir.*, Bd. XXXII, p. 442.

Wollenberg advocates the use of exercises in the treatment of coxitis deformans. In cases of pseudoankylosis of the joint a resection will give good results if it is followed by manipulations. In arthritis deformans of the knee the joint should be opened as soon as it is evident that free bodies are present in the joint, and an arthrectomy should be performed. The author administers iodides and employs hot-air baths in every case of arthritis deformans.—*A. Bruce Gill, Philadelphia.*

Catarrhal Arthritis in a Case of Scurvy. By Wolff. *Arch. f. Orthop., Mech., u. Unfallchir.*, Bd. XII., H. 4.

The author describes a case of scurvy in which there was great swelling of the knee and thigh with marked dislocation but no fluctuation. The diagnosis lay between fracture, purulent periostitis, tumor albus, arthritis, etc. The incision revealed blood-stained pus. Appropriate antiscorbutic measures soon restored the case to normal.—*Walter G. Stern, Cleveland.*

Experimental Scorbutus and the Roentgen Ray Diagnosis of Scorbutus. By Talbot. Dodd and Petersen. *Boston Med. and Surg. Jr.*, Vol. CLXIX, No. 7, Aug. 14, 1913.

The authors conclude after experiments with guinea-pigs and monkeys that scorbutus may be produced experimentally. They call attention to the "white line," seen at the epiphyseal line in the X-rays, as pathognomonic of scorbutus, and state that it is a result of increased density in the bone at that point. They also state that this "white line" may persist many months after a clinical cure of the disease and believe that it suggests that the pathological changes in the bone as a result of the disease are not repaired for many months.—*James Warren Sever, Boston.*

A Case of Rheumatic Arthritis Treated with Rheumatism Phylacogen. By Marian Erskine. *Lancet*, Sept. 27, 1913.

A case report dealing with the successful treatment by rheumatism phylacogens of (1) rheumatoid arthritis of hip and knee in a young woman of thirty-three; (2) a case of sciatica of three or four weeks' duration in a young woman; (3) a case of obstinate lumbago in a woman of forty-eight. —*J. Appleton Nutter, Montreal.*

Experimental Contribution to the Pathogenesis of Acute Hematogenous Osteomyelitis. By Dr. Fritz L. Dumont. *Deutsche Zeitschrift für Chirurgie*, Bd. CXXII, Heft 1–2.

His conclusions are that (1) it is possible to produce experimentally in young growing rabbits, by intravenous injection alone (without trauma) of staphylococcus cultures, an acute hematogenous suppurative osteomyelitis, whose clinical picture corresponds to that found in man. (2) To produce this disease, either staphylococcus aureus or albus may be used, the virulence rather than the variety is of importance. (3) The assertion that a specific organism causes the disease is not correct. (4) He has confirmed the position of Lexer, of the biologic peculiarity of the staphylococcus whereby the organism is caught in the finest vessels of the metaphyseal region, and there grows in heaps, and thus produce *pus depots.—Alexander Colvin, St. Paul.*

Arthritis Urica in the X-ray Picture. By Jacobsohn. *Mitteil. a. d. Grenzgeb. der Medizin u. Chirurgie*, Vol. XXVI, p. 531, 1913.

The author reviews the literature and reports eighteen cases from his clinic. Many cases show signs in the X-ray picture typical for atrophic arthritis or chronic articular rheumatism: Atrophy of the bones, decrease of the articular gaps, subluxation, and, at times, ankylosis. In one case marked hypertrophic proliferations with moderate atrophy was noticed, but a difference was found in so far as the ankylosis was found to be atypical. The most typical signs of arthritis urica are small or large round or half round defects of the bony substance. The author distinguishes changes of an exogenous and endogenous origin, in the former narrowing of the bone and hollowing out by the mechanical influence of tophi, in the latter caused by deposits of uric acid in the marrow and corticalis. Foci of decreased density are often similar in appearance to enchondroma. From the X-ray picture it cannot be seen whether the defects represent deposits of urate or myeloid or scar tissue or necrotic tissue. Jacobsohn comes to the following conclusions: 1. Even in such cases where the diagnosis is certain from a clinical point of view an X-ray picture is advisable to determine the amount of destruction, and it is of great importance for the prognosis. 2. Since the X-ray shows that tophi act destructively on bone tissue it seems to be a rational procedure to excise them as has been suggested by Gelibert and Lumière. 3. The X-ray picture shows in many cases changes typical of arthritis urica making the clinical diagnosis more certain. In a small percentage those signs are present in a case where the clinical picture is identical with atrophic arthritis. In such cases the X-ray examination is of a special diagnostic value.—*C. H. Bucholz, Boston.*

Causes of Error in the Diagnosis of Diseases of the Joints.—By W. R. Townsend, M. D., New York. *J. A. M. A.*, Nov. 8, 1913.

This article is a timely one and while it does not contain any new facts, the article and the discussion following it should be read by all.—*Edward S. Hatch, New Orleans.*

IV. BONE AND JOINT TUMOR, BENIGN AND MALIGNANT.

A Rare Disease of the Upper Third of the Femur. By Professor Axhausen. *Berlin klin. Wochensch.*, November 3, 1913, p. 2028.

The author reports several cases of cyst formation in the upper third of the femur, with outward bowing of the bone, in which the clinical and Roentgen pictures were similar, but in which each case presented a different pathological condition. In one case the condition shown was ostitis fibrosa; in another the disease was a senile osteomalacia. A case of syphilis of the upper third of the humerus with cyst formation is included. Two cases of deformity and marked bony overgrowth in and around the hip-joint are included, and are illustrated with good roentgenograms. Both these conditions undoubtedly followed fractures of the neck of the femur in earlier life.—*Roland Hammond, M. D., Providence, R. I.*

Solitary Exostosis in Genu Valgum. By W. Wiemers. *Arch. f. Orthop., Mech., u. Unfallchir.*, Bd. XII, H. 4.

An examination of all the X-ray plates of knock-knee taken at Cramer's Academy in Cologne showed that almost all the severe, sharply bending cases had a solitary exostosis on the inner aspect of the tibia just at the apex of the convexity. The exostosis measured from 1/2 to 1 cm. in size, and its point was directed downward. The author lays the cause of this exostosis to the resistance to the deformity offered by the internal lateral ligaments of the knee-joint, and the pull of the tendons of the pes anserinus upon the rachitic bone.—*Walter G. Stern, Cleveland.*

A Case of Exostosis of the Os Calcis. By F. Bahr. *Arch. f. Orthop., Mech., u. Unfallchir.*, Bd. XII, H. 4.

In 1902, this patient had an attack of joint inflammation simulating polyarthritis rheumatica. In 1904, after a slight injury, the right foot became swollen and painful: the patient took a two years' course of baths, etc., after which the pain and swelling subsided and the patient returned to work. He remained well until in 1910 when the right foot again became swollen and painful, and in 1911 two large, hard, dense spurs were removed from the plantar surface of the os calcis. The left heel is now (1912) causing pain in the sole and under the tendo achillis. An X-ray photograph revealed several small spurs under the heel and also a destructive process at the insertion of the tendo achillis.

The etiological factor in this case is to be found in the fact that the patient had a light attack of specific urethritis some time before the beginning of the symptoms.—*Walter G. Stern, Cleveland.*

V. SCOLIOSIS AND STATIC DISTURBANCES.

Sciatic Kyphosis. By Johann Hnátek. *Deut. medizin. Wochensch.*, October 9, 1913, p. 1989.

The author reviews the scanty literature of this subject, and reports in detail the case of a man who had assumed the stooping posture, because his pain was relieved only when in this position. There was pain and tenderness along the course of the right sciatic nerve, and the trunk was inclined to the right. The treatment consisted in galvanization, hot baths and salicylates, and recovery took place in eight weeks. (This condition is usually called sciatic scoliosis in America, and is attributed to disturbance of the sacroiliac synchondroses.)—*Roland Hammond, M. D., Providence, R. I.*

Madelung's Deformity of the Wrist (Carpus Valgus). By Peter Berg. *Arch. f. Orthop., Mech., u. Unfallchir.*, Bd. XII, H. 4.

According to Madelung, the most important changes in this condition are the bending of the distal epiphysis of radius toward the palm of the hand with the backward projection of the ulna. The carpus is projected in a direction perpendicular to the shaft of the radius, and the hand is held in slight adduction. The affliction is painless and comes on spontaneously without any previous attacks of inflammation or trauma and occurs usually in young people.

The author contends that rickets or rather late rickets is the cause of this condition, and offers many convincing arguments to uphold it. He believes it to be analogous to coxa valgum, genu valgus, pes valgus, etc., and proposes the term Carpus Valgus to designate this affliction.—*Walter G. Stern, Cleveland.*

Pes Valgus. By Looser. *Arch. f. Orthop., Mech., u. Unfallchir.*, Bd. XII. H. 3.

The pronation in pes valgus takes place in the astragalo-calcaneal joint, and its measure is the amount that the internal malleolus projects lateral to the internal border of the sole of the foot. The actual falling of the arch can be measured by a line drawn from the most posterior point of the heel to the most lateral point of the external border of the arch of the foot, as shown by an ordinary ink imprint. If this line goes through the big toe or internal to it, the foot is to be called flat. If it projects external to the great toe, the arch is normal.

The vast majority of human beings stand with their feet in more or less pronation as measured by this malleolar projection but are to be considered normal. There is no sharp line of distinction to determine normal from abnormal pronation. Flat-foot and pronation do not go hand in hand. The carrying of the weight of 54 pounds does not increase the deformity of the feet as shown by a long series of experiments on German soldiers.—*Walter G. Stern, Cleveland.*

The Causes of Knick and Flat-foot. By Dr. Paul Ewald. *Deutsche Zeitschrift für Chirurgie*, Bd. CXXI, Heft 1–2.

The leg is, by disease or injury, so altered that the articular surface of the tibia, and thus also the articular surface of the astragalus, are not parallel to the plane of the weight bearing, or that the foot is not correctly placed in the malleolar fork. Under this heading are:

1. Congenital anomalies, total or partial defects of the fibula, acquired anomalies, (a) high-grade genu valgum, due to rickets or deformed fractures, (b) increased growth in the length of the tibia, due to, *e.g.*, osteomyelitis, (c) suppuration of the ankle-joint, (d) destruction of the external malleolus by tuberculosis or lues, etc., (e) malleolar fractures of all kinds.

The tarsal bones are in consequence of bone ligament, muscle, nerve or skin disease, or injury, so altered in form, or in their relation to each other so changed, that a flat or knick foot ensues.

Congenital anomalies of form and position of the tarsal bones, (a) congenital contracted flat-foot, (b) congenital malformation of the scaphoid, (c) excessive growth of the scaphoid bone, (d) os tibiale externum.

2. Acquired anomalies in form of the tarsal bones (a) talus extirpation, (b) tuberculosis, (c) tabetic arthropathy, (d) fracture of the tarsal bones, (e) fixation in Lisfranc's joint.

Acquired anomalies in position of the carpal bones (a) the static knick and flat-foot, (b) flat-foot after club-foot redressement, (c) pes valgus and planus due to infantile paralysis, (d) cicatricial contraction of the skin or subcutaneous tissues.—*Alexander Colvin, St. Paul.*

The Valgus Position of the Foot. By Looser. *Arch. f. Orth. u. mech. u. Unfall-Chir.*, Vol. XII, p. 233, 1913.

Looser discusses the methods of measuring the pronated foot. His study was made on a material of fairly normal young men, examining the feet of 250 soldiers as to the relation of the malleoli to the os calcis. Examination was made by an imprint of the sole, by a tracing of the outline of the foot, and by the projection of the malleoli upon the paper, in order to determine whether and how much the projection of the malleoli will be found inside or outside of the outline. The author draws the following conclusions: 1. A foot is to be considered as flat, when on the print a line connecting the most posterior point with the inner border of the arch meets in its extension the big toe or falls inward from it. Forty-four per cent. of his cases gave that result. 2. The distance of the projection of the malleoli from the outline of the foot allows the conclusion of the amount of valgus position which is the greater the more inward from the outline the projection of the inner malleolus will fall. 3. A great majority of human feet show a more or less pronated position. A certain amount of valgus position is within the normal limits and there is no definite border line between normal and pronated feet. 4. Valgus position is not always parallel with flattening of the arch.—*C. H. Bucholz, Boston.*

The Treatment of Reflectoric Spastic Pes Valgus. By Anzoletti. *Zentralbl. f. Chir. u. Mech. Orth.*, Jan., 1913.

In two cases of a contracted pronated foot where for certain reasons neither general nor local anesthesia could be used the following simple method has given very satisfactory results. With a 6-foot-long tourniquet the leg was constricted at the level of the head of the fibula thus compressing the peroneal nerve. After fifteen minutes the contraction of the muscles began to lessen and fifteen minutes later complete paralysis of the muscles supplied by the peroneal nerve was obtained, thus allowing the correcting of the foot easily and putting it in a plaster cast. The tourniquet was then removed. One hour later the toes showed complete restoration of their active function and at the time of removal of the plaster cast six weeks later, all muscles were found to be intact. In making the constriction care must be taken to apply the tourniquet from inward over the front of the leg toward the outside, thus avoiding pushing the soft tissues of the calf over the head of the fibula. The tourniquet must be rolled tightly, one turn close to the other, in order to avoid squeezing the skin. This method is indicated in cases of simple muscular contracture, cases with a fibrous contracture are not suitable.—*C. H. Bucholz, Boston.*

Experiences and Opinions on the Abbott Treatment of Scoliosis. By O. Vulpius. *Berlin. klin. Wochen.*, Sept. 22, 1913, p. 1745.

The author reviews the theories of Abbott on which this treatment is based, and gives the technic of the application of these jackets. He adds his own modification of technic, such as preliminary stretching of the muscles, and sunlight treatment afterward. He believes in the internal administration of lime and phosphorus to aid in hardening the bones. In an experience of fifty cases, he is, on the whole, not impressed with the permanent results, although he is convinced that it is a distinct advance in the treatment of scoliosis.—*Roland Hammond, M. D., Providence, R. I.*

VI. CONGENITAL DEFECTS, INCLUDING CONGENITAL DISLOCATIONS.

The Clinical Significance of Spina Bifida Occulta. By Eugen Bibergeil. *Berlin. klin. Wochen.*, Aug. 11, 1913, p. 1481.

After a brief review of the literature, the author points out that this anomaly is often accompanied by other congenital defects, such as congenital dislocation of the hip, club-foot, and those deformities of static and trophoneurotic origin. Since spina bifida occulta has been studied more carefully by the Roentgen ray, it has been shown that many deformities of the vertebral column have been grouped under this term. He believes that many disturbances of the bladder, and deformities of the feet, such as claw foot, varus and valgus deformities, may be traced to this origin. It is an undoubted cause of scoliosis. Hypertrichosis as a constant accompaniment of this condition has been overestimated, since it occurs in but a small proportion of the cases.—*Roland Hammond, M. D., Providence, R. I.*

The Nature and the Origin of Achondroplasia. By Dr. Murk Jansen. *Zeit. f. für orth. Chir.*, 1913, Bd. XXXII.

Author draws the following conclusions: 1. The abnormally contracted amnion may cause pressure upon soft parts, produce anemia and thus bring about the disturbance of growth of the part affected. 2. Diminished blood supply may lead to dwarfing or entire destruction of certain rapidly growing parts. 3. The rapid expansion of the forming cartilage in the fetus determines the location and partly the degree of the dwarfism in the achondroplast.—*George I. Bauman, Cleveland, Ohio.*

Statistics of Congenital Deformity in Japan. By Hiromoto. *Arch. f. orthop., Mech., u. Unfallchir.*, Bd. XII, H. 3.

A statistical report of almost 5000 orthopedic patients presenting 462 congenital deformities, *i.e.*, 9.8 per cent. This agrees closely with Hoffa's figures in reporting 68,000 cases.—*Walter G. Stern, Cleveland.*

Cisterna-sinus Drainage for Hydrocephalus. By Haynes. *Archiv. of Pediatrics*, Sept., 1913.

The author describes an operation which he performed with good results upon an infant with hydrocephalus. A cannula was inserted with one end in the lateral sinus and the other end in the cisterna magna; and the cannula was retained in place and leakage was prevented by silk retention sutures. Two months after the operation the cannula was still in place and the condition of the child was very much improved.—*A. Bruce Gill, Philadelphia.*

Congenital Defects in Development of the Trunk. By Max Böhm. *Berlin. klin. Wochensch.*, October 20, 1913, p. 1946.

The author considers these developmental defects under five heads: 1. Malformations from intrauterine pressure. 2. Deformities due to (a) cleavage of a large section of the vertebral column, or to a single segment of the trunk. These cleavage defects may involve both halves of the vertebral bodies, both halves of the spinous processes or the arches, or the neural and costal elements. On the other hand (b) fusions may occur, which involve large areas or single segments. In the latter case, the vertebral bodies and neural elements, the arches, spinous and articular processes, and the costal elements are involved. 3. Variations, under which heading Böhm includes assimilation of a single segment of the trunk with its neighbor above, or that below, are found in the different segments of the vertebral column. The etiological relationship between scoliosis and sacralized vertebræ and cervical ribs is emphasized. 4. Bilateral asymmetry of the body of congenital origin. Besides difference in length of the legs, and in the two sides of the skull, this subdivision furnishes many cases of scoliosis. The author emphasizes the fact that scoliosis is a deformity of the entire thorax; not of the vertebral column alone. 5. Growth in a faulty direction of congenital origin. This group is concerned principally with deformities of the sternum. Embryologically considered the thorax is at first heart-shaped, but in later development becomes kidney-shaped. According as development is progressive or regressive, the sternum may assume the shape of a pigeon breast or a funnel breast.—*Roland Hammond, M. D., Providence, R. I.*

Coxa Valga. By K. Vogel. *Zeitschr. f. orth. Chir.*, Bd., XXXII, p. 225.

Concerning coxa vara much has been written, but concerning coxa valga few observations have been recorded. The subject, particularly as to its etiology, is yet somewhat obscure. Lauenstein was the first to report any cases of this deformity. Later in 1897 Thiem reported a case due to fracture in the region of the trochanter, with healing in the position of coxa valga. Then followed Albert, Hoffmeister, Reichard, Manz, David, Drehmann, Machol, Levy, Stieda, and Kumaris with reports of cases and discussions of the subject. The cases reported were ascribed to various causes: rachitis, amputation of the thigh, paralysis, osteomalacia. genu valgum, and fractures.

Vogel presents a case of his own in which this deformity appeared in a girl during adolescence. She had a fall when nine years of age, but the following day she was going about as usual. When twelve years old, she began to complain of pain in her left lower limb, which continued to get worse. She presented no sign of rickets. Examination showed evidence of left coxa valga. This diagnosis was fully confirmed by the X-ray.

The diagnosis of coxa valga is not difficult. The subjective symptoms resemble those of coxitis, but in coxa valga motion of the hip-joint is much more free than in coxitis; and the X-ray gives decisive proof of the condition.

The limb is in flexion, outward rotation, and abduction; and the range of extension, inward rotation, and adduction is less than normal. Of special significance is the low position of the trochanter below the Roser-Nélaton line.

The X-ray should be taken with the limbs at a right angle to the line connecting the anterior-superior spines and with the patellæ directly upward and with flexion eliminated. Some writers have maintained that if the lesser trochanter appears in the X-ray picture the limbs have been in external rotation and the coxa valga is only apparent and not real. This is not necessarily true as the lesser trochanter may be seen at times even when the limbs are in internal rotation.

The etiology of coxa valga is varied. It may follow fracture about the neck of the femur and be due, possibly, to treatment in too great abduction or by too strong extension, or be due to the patient's going on crutches with the injured limb hanging free before the callus has hardened.

It has been observed in cases of amputation of the thigh. Here it is probably due to the fact that the femur is no longer used for weight bearing. The coxa valga of paralytics is due to the same cause, absence of weight bearing.

Congenital cases are usually double sided and are related genetically to congenital dislocation of the hip, to which the valga is the first step. Also when one hip is dislocated there is often a coxa valga on the other side. It is to be remembered that the angle of the neck of the femur may vary normally to a considerable degree, possibly between 108° and 140°, and that this angle is greatest during infancy before the child walks. As the child gets older the angle lessens. Here again the influence of weight bearing is evident.

The author's case of adolescent coxa valga in a healthy child is to be explained possibly as due to injury at the epiphyseal line occasioned by the fall when the child was nine years of age.

The author treats the condition by heavy extension on the sound limb and lighter on the affected one with counter-extension on the affected side. Bier's heated air baths are to be employed and possibly osteotomy of the deformed femur.

The prognosis is usually favorable.—*A. Bruce Gill, Philadelphia.*

VIII. TRAUMATIC LESIONS, FRACTURES AND DISLOCATIONS.

The Forensic Aspect of Various Fractures of the Foot. By Plate. *Arch. f. Orthop., Mech., u. Unfallchir.*, Bd. XII, H. 4.

Fracture of the foot is very common among the workers in the various metal trades, and an average length of the disability in forty cases, was twelve weeks. The restoration of function was not entirely satisfactory because of excessive callus formation, joint stiffness, muscle weakness, neuralgia, swelling, delayed or nonunion and deformity, usually flat-foot.

Most fractures occurred by direct violence and took place at the point of impact.

The author calls attention to the normal variations of the bones of the feet. In all cases of doubt, both feet are to be radiographed.—*Walter G. Stern, Cleveland.*

Some Surgical Features of Injuries of the Spine, with Special Reference to Spinal Fracture. By Chas. A. Elsberg. *Annals of Surgery*, Vol. LVIII, No. 37, Sept., 1913.

The author speaks of the frequency of injuries to the spinous and transverse processes and the laminæ of the vertebræ. He believes that many of the so-called "sprains of the back" are really fractures of part of a vertebræ, or rupture of a vertebral ligament. He reports several cases of rupture of the spinal ligaments, and fracture of the spine, and discusses the question of early and prompt surgical intervention in cases where "incomplete" cord symptoms are present. By "incomplete" cord symptoms he means that the cord still functionates somewhat and that its destruction is not complete, as shown by only partial loss of power below the injury. Sensation may be well preserved—reflexes present and control of sphincter not involved. Later there may be destruction of the cord from hemorrhage or bony pressure. In all cases X-rays of the spine are to be taken if possible from the side as well as from the front.—*J. W. Sever, Boston.*

Fracture of the Lip of the Acetabulum. Under this title is given a case report by Dr. M. J. Guyot in the *Journal de Médecine de Bourdeaux. Lancet*, Oct. 11, 1913, p. 1077.

It has to do with one of those minor fractures which have received little attention because they could not be diagnosed before the introduction of radiography.

A laborer aged forty-one sustained a severe contusion of the left hip by earth falling in upon him. After the accident he complained of pain shooting from the root of the penis to the left hip and sacroiliac joints. Anything but a short step was prevented by pain in the hip. No deformity or vicious attitude of the limb. Pain in separating the thighs, and outward rotation of the hip was painful and limited. A radiogram clearly showed that a fragment of the lip of the left acetabulum at the upper part had been broken off. There was a region of greater transparency in the neighborhood which suggested the existence of some osteitis.

There was crepitus in the left hip, also the right hip and both knee joints.—*J. Appleton Nutterr, Montreal.*

Deformity Observed Ten Years after an Accident. A case reported by Dr. Max Herz in the *Australasian Medical Gazette* of June 21, 1913. *Lancet*, Oct. 4, 1913, p. 1012.

A boy of five years fell and injured his left wrist, which became slightly swollen and painful for a few days.

Ten years later it was noticed that the boy's hand was deflected toward the radial side. An X-ray revealed that the outer side of the radial epiphyseal zone had ossified prematurely, retarding growth; the ulnar side had developed into a spur, the growth of which pushed the hand into a valgus position.

The peculiarity is the interval of ten years between the injury and the observation of the deformity. Both the boy and his parents were persons of high intelligence.—*J. Appleton Nutter, Montreal.*

The Operative Correction of Fractures in Bad Position. Dr. William Keppler. *Deutsche Zeitschrift für Chirurgie*, Bd. CXXI, Heft 1–2.

The functional result is not always dependent upon a correct anatomical position, as seen in the radiograph, although such is frequently the case. It is usually necessary, however, that the bones are healed in the normal axis of weight bearing. This can usually be obtained by nonoperative measures, and it is only exceptionally that operative measures are indicated.

The fixation of fractures by foreign material, such as metal plates, etc., undoubtedly gives an excellent result at times, but often at too great a cost. The exposure of the fragments for such purposes leads unavoidably to a great deal of manipulation and destruction of tissue, and the time required also increases the risk of infection. The removal of these foreign substances is required frequently, and often a long time after their implantation.

The belief that interposition of soft tissues and blood coagula favor delayed or nonunion, is not tenable. On the other hand, it is believed that these favor callus formation.

Recognizing the necessity at times, however, for the correction of misplaced fragments, the operative correction, with as little manipulation and disturbance as possible is advised, and where possible, and artificial impaction brought about. After this is done, the same character of splinting and after-treatment is required, as is used in ordinary nonoperative treatment. The results are excellent.

The technic of the author's procedures is given in radiographic illustrations, both before and after treatment, to prove the correctness of his claims.—*Alexander Colvin, St. Paul.*

Uncomplicated Fractures of the Tarsal Scaphoid. By A. E. Horwitz, St. Louis. *Annals of Surg.*, Vol. LVIII, No. 4, Oct., 1913.

The author states that uncomplicated fractures of this bone are not as rare as has been supposed. They frequently pass as sprains of a severe type. Discomfort is felt in walking and a flat-foot usually results. No great violence is required to produce this fracture, and the lesion is usually found at the tubercle of the scaphoid—which is generally found separated, and which as it has a separate center of ossification from the rest of the bone, can be regarded as an epiphysis. Undue tension on the tibialis portions may also cause a separation of the tubercle. Treatment is usually sought on account of a weak ankle. Abduction of the foot is painful. Eight cases are reported—four in adults and four in adolescents. The treatment consists of immobilization for ten to fourteen days, followed by massage and felt pads.—*James Warren Sever, Boston.*

The Reduction of the Fragments Preliminary to Internal Splintage in Cases of Fracture of the Long Bones. By G. H. Colt, Aberdeen, Scotland. *Annals of Surg.*, Vol. LVIII, No. 4, Oct., 1913.

This article describes an instrument or better a mechanical appliance, for use in reducing overriding fragments in fractures of the long bones. It seems reasonable and in some cases is probably of use.—*J. W. Sever, Boston.*

Simultaneous Fracture of Both Patellæ. By C. R. Steinke. *Annals of Surgery*, Vol. LVIII, No. 4, Oct., 1913.

The author reports two cases, with results following operation. He also summarizes the cases of simultaneous fracture of both patellæ found in the literature, of which there were forty-four. The manner of fracture was as follows: Thirty-five were fractured by indirect violence, nineteen by direct violence and two by a combination of indirect and direct violence. In thirty-four cases, or sixty-eight patellæ, seventeen were not operated—twenty-eight were wired, nineteen were sutured, three looped and one removed. In all fifty-one patellæ were treated by an open operative method and each obtained a good functional result.

He concludes that simultaneous fracture of both patellæ is a rare condition, occurring in less than 1 per cent. of all cases of fractured patellæ, and that a poor functional result may be expected unless the patient is given the advantage of an open operation.—*James Warren Sever, Boston.*

Report of Eighteen Cases of Separation of the Lower Femoral Epiphysis at the Boston City Hospital. By Horace Binney and Fred B. Lund, Boston. *Boston Med. and Surg. Jour.*, Vol. CLXIX, No. 2, July 10, 1913.

The authors report a very interesting series of cases. They speak of hyperextension as being the usual form of violence necessary to produce such a condition. In many cases compound injuries occur, in others the lesion is a simple displacement without serious injury to the soft parts.

They speak of the danger of arrested growth of the leg from such an injury, and state that it must be always considered in the prognosis. When there is a tendency to displacement of the epiphyseal fragment, at time of operation in compound fractures, the fragment may be fixed by a wire nail, a bone plate, or wire. It is best in these cases, however, to remove such a foreign body by the end of three weeks, to prevent any possible disturbance of epiphyseal growth. Excision of the joint is probably never necessary, for it will remove the epiphysis and will therefore form a very serious impediment in growth, so that a marked shortening will result.

They conclude that:

(1) Owing to danger of subsequent interference with growth, absolute reduction and fixation at the earliest possible moment is of great importance.

(2) Repeated X-rays are necessary.

(3) In single cases where immobilization in flexion fails to hold the fragment in correct position from the start, open reduction, with the use of a small nail or bone plate is indicated.

(4) In compound separation the same means of positive fixation is to be recommended.

(5) The foreign body should be removed soon after union has begun, in order to avoid interference with growth. This should be done not later than the third week.—*James Warren Sever, Boston.*

Injury to the Epiphysis of the Tibia in Adolescents. By Ebbinghaus. *Deut. medizin. Wochen.*, Aug. 21, 1913, p. 1639.

This injury appears about puberty in otherwise healthy children. It may occur as a simple separation, or as a tearing off of the epiphysis. It is probably more frequent than is generally supposed, and may begin as late as the sixteenth year. Its existence can be determined accurately by the Roentgen method. The condition is to be regarded as an epiphysitis. The author believes that it is best treated surgically, by removal of part of the epiphysis, but admits that this opinion is not shared by most of his colleagues. He advises against strenuous sports, which may produce this injury, between the twelfth and sixteenth years.—*Roland Hammond, M. D., Providence, R. I.*

Holding Fractures with Absorbable Material, Ivory Plates and Screws. By P. B. Magnuson, M. D., Chicago. *J. A. M. A.*, Oct. 25, 1913.

The author uses ivory screws and ivory bone plates which are set into the bone in a longitudinal direction across the line of fracture. In this way there is very little strain put on the plates, and they are claimed to be superior to steel plates applied on the outside of the bone, and they are less of a foreign body.—*Edward S. Hatch, New Orleans.*

VII. APPARATUS AND X-RAY.

The Use of Artificial Arms in a Case of Amputation of Both Arms above the Elbow. By Heisler. *Arch. f. Orthop., Mech., u. Unfallchir.*, Bd. XII, H. 4.

A remarkable demonstration of the ability of such a patient to care for himself, and in part to become self-sustaining by the use of ingeniously constructed artificial arms. The patient could even write a good legible "hand."—*Walter G. Stern, Cleveland.*

Braces and Apparatus, a Report of the German Literature appearing in 1912. By Wilhelm Becker. *Arch. f. Orthop., Mech., u. Unfallchir.*, Bd. XII, H. 4.

The various extension methods to be used in fractures are fully discussed. Codivilla's nail extension used as described in America by Freiberg, of Cincinnati, is recommended as the best brace material. Vulpius describes a new and very practical hip-joint for braces.—*Walter G. Stern, Cleveland.*

Spondylolisthesis in Roentgenology. By Alb. Wiemers. *Arch. f. Orthop., Mech., u. Unfallchir.*, Bd. XII, H. 4.

Spondylolisthesis is a spontaneous loosening of the lumbosacral articulation and a slipping forward and downward of the vertebral column upon the upper surface of the sacrum. The last lumbar vertebra may be subluxated *in toto*, or its body and the anterior half of its arch may be dislocated, while the spine. the inferior articular surface, and the posterior half of the arch may remain in place and in time even become firmly ankylosed to the upper surface of the sacrum. While Breus-Kolisko defines spondylolisthesis as "the spontaneous slipping forward of any vertebra," the majority of cases of this sort occurred in the fifth lumbar vertebra. Slipping of the fourth lumbar vertebra and the first sacral are much rarer.

The author describes minutely two most interesting cases of this deformity.—*Walter G. Stern, Cleveland.*

The Value of Roentgenography of the Bones and Joints in Orthopedic Surgery. By G. Fedor Haenisch. *Deut. medizin. Wochensch.*, October 16, 1913, p. 2039.

This article is a comprehensive review of the diagnostic value of roentgenography in bone and joint diseases, delivered at the International Congress of Medicine in London. The article covers the subject in an able manner, but obviously does not lend itself to abstracting.—*Roland Hammond, M. D., Providence, R. I.*

VIII. MISCELLANEOUS DISEASES. GENERAL ORTHOPEDIC ARTICLES. PHYSICAL THERAPY.

Therapeutical Exercises Performed before a Mirror. By H. W. Frauenthal. *Internat'l. Clinics*, Vol. II, 23, Sr., p. 56.

In this method of exercising, the mind is concentrated on each muscular effort. The patient observes in the mirror each contraction of a muscle or group of muscles and becomes gradually skilled in exercising such muscle or muscle group to the exclusion of all other muscles. The weak and undeveloped muscles can therefore be exercised alone, while the normal muscles remain unexercised.

This method is applied to infantile spinal paralysis, lateral curvature, tabes dorsalis, etc.—*A. Bruce Gill, Philadelphia.*

Clavicle Plastic from the Spine of the Scapula. By Dr. Molineus *Deutsche Zeitschrift für Chirurgie*, Bd. CXXI, Heft 1–2.

To replace partial or total defect of the clavicle, the spine of the scapula is chiselled off and turned forward, to fill the defect. The results were excellent. The technic of the operative procedure is given.—*Alexander Colvin, St. Paul.*

Bone Plastic in Pseudarthrosis of the Tibia. By Vulpius. *Zentralbl. f. Chir. u. Mech. Orth.*, April, 1913.

In cases where injections with various materials and even the suture of fragments had failed, a plastic operation with a pedunculated flap of bone with periosteum has given splendid results. Vulpius' technic is as follows: A hook-shaped flap of the periosteum, with its base proximalward, is circumcised on the proximal fragment; with a fine chisel a rather thick layer of bone is lifted with the periosteum attached to it and the flap is turned downward bridging over the pseudarthrosis. Then a bed is dug out underneath the periosteum of the distal fragment giving sufficient room for the flap, and the periosteum of the lower fragment which had been turned partly sideways and partly downward is sutured over the transplanted flap. Good results were obtained in obstinate cases, some of which had been invariably treated for years, cases of a traumatic, congenital, and postosteomyelitic nature.—*C. H. Bucholz, Boston.*

Osteotomy. By Bruno Kuenne. *Zentralbl. f. Chir. u. Mech. Orth.*, Feb., 1913.

Kuenne has constructed an electric circular saw for osteotomy of long bones. Its advantages are that it cuts the bone without shaking the marrow and that the edges of the periosteum and bone are smooth and not torn.—*C. H. Bucholz, Boston.*

On the Operative Treatment of the Ankylosed and Contracted Knee-joint. By Wreden. *Zentralbl. f. Chir. u. Mech. Orth.*, April, 1913.

Wreden describes the following operation: From a skin incision of the shape of a reversed Y above the knee-joint the upper recessus is pushed downward and a hole is bored just above the lower epiphyseal line of the femur into the bone down to the posterior corticalis. Then the femur is sawed with a Gilgi saw just above the hole; the lower end of the shaft is pointed with a saw, and put into a hole after straightening the leg which is possible without straining the popliteal vessels and nerves. A displacement of the fragments cannot happen. After closing the wound a plaster cast is applied for four weeks. During the last three years twelve patients have been operated in that way with a good functional result. The shortening of the leg is usually not more than 2 cm. The epiphysis remains intact and special advantages of this operation are in that any persistent tuberculous focus is not touched and that any motion of the joint is conserved.—*C. H. Bucholz, Boston.*

Massage and Gymnastics, a Report of the German Literature appearing in 1912. By Wilhelm Becker. *Arch. f. Orthop., Mech., u. Unfallchir.*, Bd. XII, H. 4.

Kuhn describes a machine which combines massage with a high pressure breathing apparatus which offers a resistance of 1 1/2 atmospheres to expiration. A claim is made that continued forced respiration against direct pressure reduces the viscosity of the blood and is curative in threatened spontaneous gangrene.

Taskinen claims that massage hastens the absorption of salicylates.—*Walter G. Stern, Cleveland.*

BOOK REVIEWS:

ORTHOPÆDISCHE OPERATIONSLEHRE. By Prof. Dr. Oskar Vulpius and Dr. Adolph Stoffel, mit 446 Illustrations. Published by Ferdinand Euke, Stuttgart, 1913. Price, 20 marks.

A work dealing entirely with the operative side of orthopedic surgery, and this of the modern sort. The manipulative side of orthopedic surgery, as well as the use of massage, mechanical gymnastics and corrections, are not described, the entire work covering nearly 500 pages, is concerned only with the actual surgical procedure in use to-day. Older operative methods now obsolete are not introduced, it being the authors' intention to separate the good from the bad, and to produce a volume containing only the justifiable operative measures in use by those best qualified at the present time. And this intention is strikingly well carried out. Even a casual glance through this work, even a hasty study of its illustrations, will satisfy the most critical that it has a place as a book, and one, indeed, that has long been unfilled.

The book is divided into four sections: The first of these deals with the "Operations on the Muscular System." Here is set forth the technic of practically all the operations on muscles and tendons that are in good surgical usage to-day. The plates illustrating tendon shifting are the best that have as yet appeared.

The second section deals with "Operations on the Nervous System," and herein Dr. Stoffel describes the technic of the peripheral nerve operation that bears his name. Root section after Forster is also described.

Section three deals with the "Operations on Bones."

Section four deals with the "Operations on Joints." In this last section is set forth a summary of all the recent operative work done to reestablish joint motion. The operations of Payr and Lexer are described, as well as much else of greatest interest to those doing this class of surgical work. In the subhead of this section, devoted to plastic operations on the spine, the operative technic of the Albee, the Hibbs and the Lange operation for spondylitis is described.

On the whole, it is a most valuable work and one that is needed in this branch of surgery. It offers abundant proof of the remarkable advance orthopedic surgery has made.

THE POSTURE OF SCHOOL CHILDREN, WITH ITS HOME HYGIENE AND NEW EFFICIENCY METHODS FOR SCHOOL TRAINING. By Jessie H. Bancroft, Assistant Director Physical Training Public Schools of New York City. New York: The MacMillan Company, 1913. Price, $1.50.

The author wishes to aid both home and school by this little volume, and presents the facts of the case accordingly, in simple, untechnical language. Improper posture, with its results, is described. Proper posture—that is, the habitual correct and erect carriage of the body—is also fully set forth. Though the work is not of especial service or interest to those who specialize in these subjects, there are, nevertheless, many valuable illustrations. But its author's avowed purpose is not to reach them, but to make much of this subject more clear to parents and teachers, and here the book has a mission, and an important one, which it admirably fulfills.

THE SURGICAL CLINICS OF JOHN B. MURPHY, M. D., at Mercy Hospital, Chicago. Volume II. Number V (October, 1913). Octavo of 174 pages, 52 illustrations. Philadelphia and London: W. B. Saunders Company, 1913. Published Bi-monthly. Price per year: Paper, $8.00. Cloth, $12.00.

This volume of Murphy's Clinics is so similar to other volumes that it requires no special notice. There are several cases reported which are of especial interest to orthopedic surgeons: One of ankylosis of the knee, with an old focus of infection in the tissues outside the knee, discovered by operation. In discussing this case, Dr. Murphy gives his views on the management of joint infections, such management having for its object the prevention of ankylosis.

Another case of interest is one of ankylosis of the hip, following a sore throat—what Murphy calls "metastatic arthritis." Here he has done an arthroplasty.

A third case of interest is one of osteitis fibrosa cysticus of the upper end of the femur. Here he placed a transplant in the cavity.

To the reviewer, these reports appearing every two months are as grist from the mill—the same set of clinical observations is being gone over again and again. The text shows signs of improvement, but the old faults of loose statement and dogmatic expression of opinion are still in evidence.

PRIMARY NURSING TECHNIC FOR FIRST-YEAR PUPIL NURSES. By Isabel McIsaac, Graduate of the Illinois Training School for Nurses; formerly Superintendent of the Illinois Training School for Nurses; Honorary Member of the British Matrons' Council; Charter Member of the Nurses' Associated Alumnæ of the United States; Member of the American Society of Superintendents of Training Schools for Nurses; a Director of the American Journal of Nursing; a Trustee of Mercy Hospital, Benton Harbor, Michigan. New York: The MacMillan Company, 1912.

This is a small text-book, designed to give to the pupil nurse at the beginning of her training simple, definite instructions in nursing technic. Much criticism has been heard upon the teaching of nurses, and it lies within the province—and, indeed, should be felt the duty of every teacher

—to study the causes of these defects, and rather than give the pupil nurse huge masses of indigestible information, to begin upon simple lines, which will prove a strong foundation, upon which may be borne almost indefinite elaboration.

The author believes that after the first routine groundwork has been gone over, pupil nurses are best taught by topic, with every available authority, both nursing and medical, put within their reach, with a teacher, or librarian, to teach them how to get up their topics. But in the first place, they must understand certain simple facts about personal hygiene, ward hygiene, beds and bed-making, baths, ward routine, symptoms and asepsis, and it is the object of this little volume to supply these.

ORTHOPEDICS IN MEDICAL PRACTICE. By Prof. Adolf Lorenz, Regierungsrat, Director of the Imperial University Ambulatorium for Orthopedic Surgery in Vienna, and Dr. Alfred Saxl, Assistant Surgeon in the Imperial University Ambulatorium for Orthopedic Surgery in Vienna. Authorized Translation from the German by L. C. Peel Ritchie, Ch. M., M. D., F. R. C. S. Edin., Late Volontar-Arzt in the Imperial University Ambulatorium for Orthopedic Surgery in Vienna, Tutor in Clinical Surgery, University and Royal Infirmary, Edinburgh. With 39 Illustrations. New York: William Wood and Company.

Many articles have been written and some books published on the relationship that exists between orthopedic surgery and neurology, but it has remained for Lorenz and Saxl to produce a volume on the overlap between orthopedics and medical practice.

A glance at this volume is enough to show how few are the diverse branches of medicine on which orthopedic surgery has not, at least, some bearing. There is a more intimate relation between internal medicine and orthopedic surgery than at first glance might appear to be the case. A closer scrutiny, however, will show that it is under the eyes of the physician that the early symptoms, at first subtle and, therefore, easily overlooked, of not only many congenital, but also of nearly all acquired deformities, reveal themselves. A slight acquaintance, therefore, with orthopedics is of great value to the pure physician and family doctor, as it will enable him to escape the odium attached to a mistake in diagnosis and a consequent useless course of treatment. It is to this purpose that this book is dedicated.

The Diseases of the Respiratory System, of the Circulatory System, of the Urinary System and of the Nervous System are dealt with in chapters under these heads, and there is also a chapter on Diseases of the Locomotory System.

The work is not a text-book on orthopedic surgery, but instead carries out its purpose of pointing out possible mistakes in early diagnosis in a most admirable manner.

SURGERY OF THE VASCULAR SYSTEM. By Bertram M. Bernheim, A. B., M. D., Instructor in Surgery, The Johns Hopkins University, Baltimore, Md. With 53 Illustrations in Text. Philadelphia and London: J. B. Lippincott Company.

Blood-vessel surgery offers so many possibilities for future development and is in such an early period of its growth that any statement in book form of the brilliant laboratory experimental work that has been going on in the past few years is most welcome. The author of this work has made an attempt to set forth in a practical and suggestive way the various methods now employed in the experimental field of vascular surgery; also such methods as are in clinical use.

In considering the subject of aneurysms, the anatomical, pathological and etiological sides are omitted and the descriptions of operative procedures, where several methods have been devised, are confined to the one or two best methods, and these are described in detail. This, of course, spares the writer and the reader much tedious labor.

The chapters on Transfusion and on the Surgery of the Heart are of particular interest from a clinical standpoint.

From the experimental standpoint, the expositions of vessel anastomosis and transplantation are of most striking significance and interest.

ORTHOPADISCHE CHIRURGIE. Von Dr. Gust. Albert Wollenberg, Privatdozent, Mit 147 Abbildungen im Text. Leipzig, 1913, Verlag von Dr. Werner Klinkhardt. Leitfaden der Praktischen Medizin, Herausgegeben von Professor Dr. Ph. Bockenheimer, Berlin.

This volume on orthopedic surgery is a small hand-book meant for the practicing physician. It contains nothing that is strikingly new, but there are in its pages many illustrations of methods and certain technical details that are of value not only to the practicing physician, but to the orthopedic surgeon.

NOTAS CLINICAS DE CIRUGIA ORTOPEDICA. por Adolfo Lopez Duran, Medico de la Real Casa, Jefe del Dispensario de Cirugia ortopedica y osteo-artropatias del Instituto Rubio. Jefe del servicio quirurgico del sanatorio maritimo de Oza (La Coruna). Folleto 2. Curso de 1911 a 1912. Madrid: Imp. y Encuad. de Valentin Tordesillas, Tutor, 16. 1913.

The Lancet, August 9, 1913, contains review as follows (p. 395): The first part deals with the treatment of tuberculous joints. Dr. Duran, who is chief of the surgical service of the Marine Sanatorium for the treatment of tuberculous joint diseases in children, at Oza in the Province of Coruna, gives his conclusions as to treatment:

(1) Tuberculins and antituberculous sera and vaccines have up to the present failed as specifics.

(2) Chemotherapy has excellent results to its credit—iodoform, used in the form proposed by Von Mosetig, is likely to prove of great aid.

(3) Sea-air and high altitudes are the only hygienic auxiliaries of marked efficacy.

(4) Conservative methods of treatment are of limited application. They should be adopted first, however, especially in children, but should at once give way to operative measures when skiagraphy reveals a stationary, or an advancing lesion.

(5) Conservative operative measures employed at the right time and aided by Von Mosetig's iodoform mixture give good results whatever the age of the patient; their employment, however, should not be tardy.

(6) Resection should be the rule in adults—the exception in children. With it should be combined the use of Von Mosetig's preparation.

The second paper deals with Volkmann's ischemic contracture, and describes in detail the operative procedure he adopts for the cure of the condition by the division of the tendons of the contractured muscles and the insertion of artificial tendon of silk, after the method of Lange.

Compression of the arm he regards as the essential etiological factor, symptoms of nerve involvement being, in his opinion, secondary and non-essential.

DISEASES AND DEFORMITIES OF THE FOOT. By John Joseph Nutt, B. L., M. D., Surgeon-in-Chief, New York State Hospital for the Care of Crippled and Deformed Children, etc., etc. Illustrated. New York: E. B. Treat and Company. 1913. Price, $2.75.

This small volume is prepared as a hand-book for the use of physicians who have not had time or opportunity for a thorough study of the often-neglected subject of the human foot, its diseases and deformities, and who keenly feel their inability to prescribe scientifically and successfully for the many who consult them regarding their pedal symptoms.

The Anatomy and Physiology of the Foot are the most interesting chapters to the orthopedic surgeon.

On the whole, it is a very pleasing volume and contains in simple form many points that are of value, not only to those for whom it is written, but to the specialists in this division of surgical practice.

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VOLUME XI. APRIL, 1914. NUMBER 4

The American Journal of Orthopedic Surgery

XXXVI.

CONGENITAL LUXATION OF THE HIP.

BY DR. P. LE DAMANY,

Professor in the Medical School of the University of Rennes, France.

In the correction of the malformations of the human body it is necessary to place in the first rank the treatment of congenital luxations of the hip. The importance of this part of orthopedic surgery constantly increases. To render it of rational and lasting effect it is necessary, or at least extremely useful, to recognize the causes and mechanism of the deformity which we have to cure.

In the study of the development of the human being congenital luxation of the hip forms a special chapter without analogy in the other branches of pathology. We cannot be prevented from following the causes as far as it is necessary in order to have a clear and complete comprehension of them. Our pathogenic researches on congenital dislocation of the hip have led us far from orthopedic surgery and even far from human pathology. The studies of comparative anatomy, ontogeny, normal and pathologic anthropogeny have forced us into the domain of philosophic theories, into that of transformation in particular. To understand the production of this deformity it is necessary to take a glance at certain transformations sustained by the vertebræ, transformations in which the human species is the termination.

The philosophic conclusion of these observations is that man represents the last step of a series characterized by the enormous development of the brain, the excessive breadth of the pelvis, and the extreme length of the femur. The pathologic consequence of this disproportion is the congenital dislocation of the in so far as provisions of this kind are valuable, we ought to consider as impossible the appearance of a being cerebrally as elevated above man as man is elevated above the anthropoids.

But conclusions of this sort are not justified in a paper such as this. For readers who may have the desire to investigate further I simply add that there may be found a complete exposition of this subject in my book, "Congenital Luxation of the Hip" (Alcan, Publisher, 108 Bd. St. Germain, Paris, 1912). Leaving this elevated consideration, the theories of which appear idle to many persons, we will all agree that the exact knowledge of the mechanism by which the luxation is accomplished ought to teach us to what mechanical principles to turn in order to cure it. They will be the reverse of the causal actions, and except that their direction will be directly opposed they will be directly copied from them.

Two Malformations of the Human Fetus (Torsion of the femur and partial levelling of the acetabulum).—These malformations constitute two anomalies in ontogeny. They belong to a group of skeletal changes peculiar to man. At most, one finds a vague outline of them in the anthropoids. They are due to the extreme difficulty with which the human fetus accommodates itself to the ovoid form of the maternal uterus. Its accommodation to this form is remarkable (Fig. 1). This is necessary on account of the too great length of the femur. No species of animal possesses a femur, the length of which in relation to the other dimen-

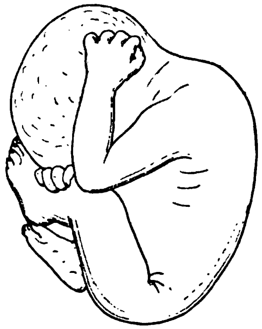


FIG. 1.—The ball-like shape of the human fetus in the uterus is excessive. It is in a difficult position.

sions of the body is at all comparable (Fig. 2). This hyperflexion is obstructed by the too great projection of the anterior and superior iliac spine and the too great width of the pelvis. The ball-like shape is not voluntary on the part of the fetus, but is imposed on it by the uterus wall of the mother. Its thighs strike against the anterior and superior iliac spines and on these projections they rock, like levers of the first class. The result of this is malformations which easily take place in bones still in the course of development and in great part cartilaginous.

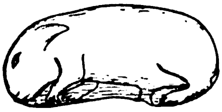
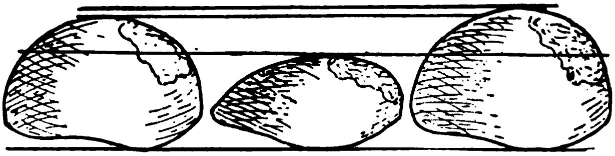


FIG. 2.—The young of quadrupeds, thanks to the shortness of their limbs, are comfortably situated in the uterine cavity.

One of these changes is the diminution in depth of the cotyloid cavity and the other is the torsion of the femur.

During the entire extent of life the cotyloid cavity has in all quadrupeds the form of a hemisphere Its depth in relation to the diameter is the same at birth as at the first stage of intra-uterine life. It does not undergo any diminution during the last portion of its stay in the maternal uterus.

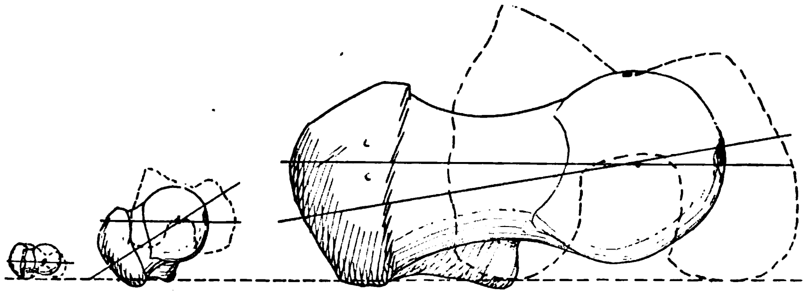


Fetus of six months. Fetus at term. Child of three years.

FIG. 3.—Drawings made after three measurements of the human acetabulum. To facilitate the comparison of the height, the diameters are supposed to be equal.

In the case of the human fetus the acetabulum is hemispheric during the first two-thirds of fetal life, but during the last three months its depth in relation to its width gradually diminishes. Originally, as among the animals, this depth was five-tenths of the diameter. At birth it is not more than four-tenths. From a hemisphere the cavity is reduced to a third of a sphere (Fig. 3). In adult life the depth of the cavity is equal at least to six-tenths of its diameter. The cotyloid cavity with its rim has become two-thirds of a sphere. The anatomists have been mistaken in believing that the acetabulum was in the beginning flat like the glenoid cavity of the shoulder. Its lack of depth is peculiar to the human species, it only exists at birth, and is the result of deformity. This change in the cotyloid cavity is full of danger for the infant at the beginning of extrauterine life.

The femur also is deformed. Place on the same flat table (Fig. 4). The femur of a fetus of four months, that of a newly born infant, and that of an adult. Let us suppose, which is true, that the axis of the inferior extremity is parallel to the surface of the table in each case. Here is what we shall then see. In the fetus at four months the superior extremity will be parallel to the surface of the table; in the case of the fetus at term will make with the surface of the table a considerable angle, varying with the individual and averaging about thirty-five degrees; in the adult this angle will not be more than about twelve degrees. The femur, then, is twisted during intrauterine life and is untwisted incompletely after birth, and the torsion of the femur corresponds to what one calls the anteversion of the head.



Fetus of four months. Torsion 0°.

Fetus at term. Torsion 35°.

Adult. Torsion 12°.

FIG. 4.—Torsion of the femur before birth. Its partial detorsion after birth. The bones are supposed to be placed on the same table and seen shortened through the superior extremity.

Torsion of the femur and flattening of the acetabulum arise from the same mechanical causes. The hyperflexed femur becomes a lever of the first class. The power is the pressure exerted by the uterine wall on the knee. The fulcrum is at the anterior and superior iliac spine which arrests this flexion. The resistance is at the acetabulum which fixes the femoral head. The disposition of these forces is indicated in Fig. 5. Between the iliac fulcrum and the acetabular resistance there is the superior diaphyseal line of ossification (Fig. 6). At this level the

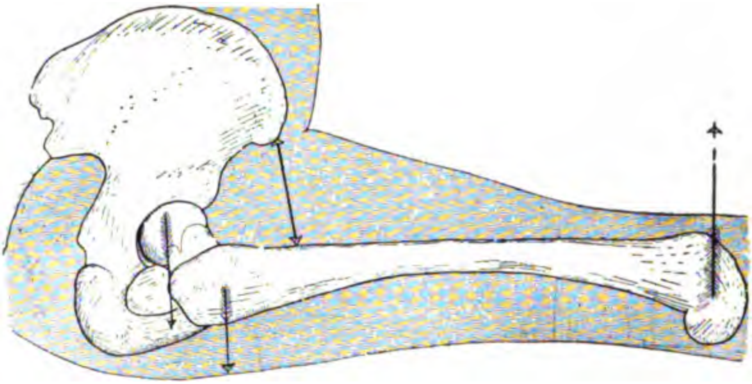
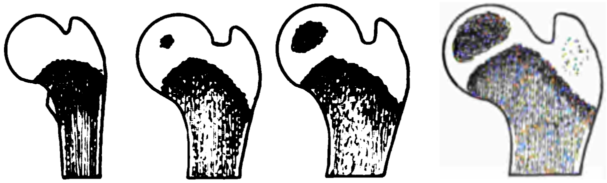
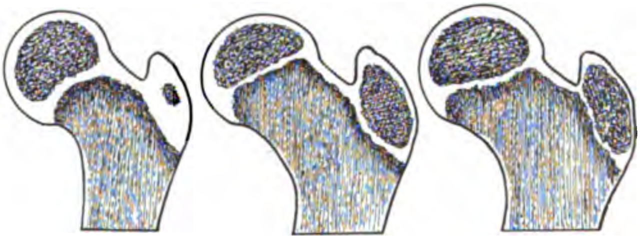


FIG. 5.—Action of the uterine wall of the thigh of the human fetus. The hyperflexion by the tendency to rock on the support of the anterior and superior iliac spines twists the femur and diminishes the depth of the acetabulum.



Newly born. One year. Two years. Three years.



Four years. Six years. Eight years.

FIG. 6.—Diaphyseal line of the superior extremity of the femur. It is at this level that the torsion and detorsion of the bone is produced.

bone is formed of young soft tissue, of cartilage in the process of osseous transformation. At this point by a mere excess of flexion of the thigh the superior epiphysis turns on the diaphysis slowly but progressively. The trochanter is displaced, approaching the ischium, while the head of the femur remains fixed. The torsion of the femur is nothing but this rotation of the superior epiphysis on the shaft of the bone.

After birth it will correct itself by a similar mechanism, but in the opposite direction, in the progress of the adaptation to dorsal decubitus and the upright posture, the two characteristics of man. The cause is the forcible extension of the femur demanded by these two attitudes. The necessary support is furnished by the anterior vertical fibers of the articular capsule in a state of tension.

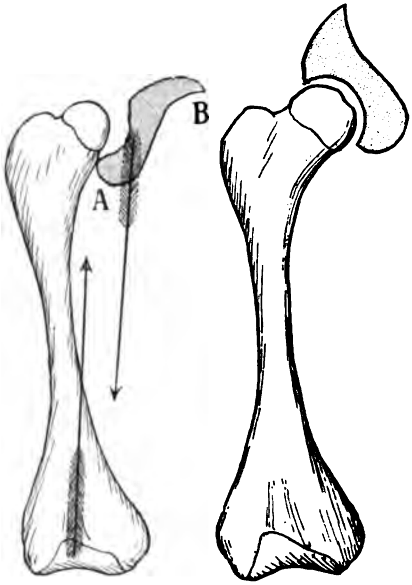


FIG. 7.—Normal hip and hip with bad conformation through poor orientation of the articular cavity.

The torsion of the femur results from the difficulties which the human fetus has to adapt its form to that of the maternal uterus. Detorsion is caused by the difficulty which is experienced in putting the femur in a position of sufficient extension for the upright posture.

The atrophy of the cotyloid cavity during the last months of intrauterine life is due to the same cause as the torsion of the femur. From the continuous push exercised by the uterine wall on the inferior extremity of the thigh (Fig. 5) there results a diminution in the pressure exercised by the pressure of the head of the femur on the acetabulum. Now, it is the pressure of this head which hollows and molds the cavity. If this is suppressed the acetabulum atrophies very quickly. By well-combined experiments it is easy to reproduce both these femoral torsions and these diminutions in the depth of the acetabulum. If certain observers have obtained different results it is because they have not sufficiently studied the conditions which permit of their production. But in nature they are absolutely peculiar to man. They exist in every human fetus, and from their exaggeration results the congenital luxations of the hip, or rather a category of these luxations.

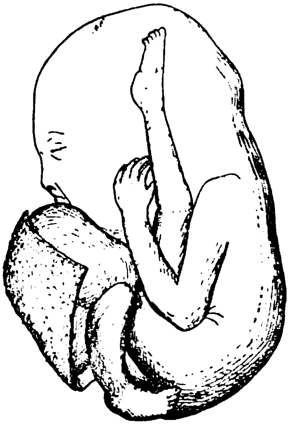


FIG. 8.—Embryo of three months with luxation of the right hip through bad position of the thigh.

Before going further it is necessary for us to show the pathogenic multiplicity of congenital luxations of the hip. Indeed, to thoroughly understand the congenital coxo-femoral dislocations that the surgeon treats it is necessary to know that there are other kinds and that the whole forms a complex group in which a classification is necessary. They can be divided into teratologic luxations and anthropologic luxations.

1. *Teratologic Luxations.*—They have varying mechanism and numerous causes so that we can subdivide them in the actual state of our knowledge and reserve for ourselves the possibility of adding new categories in the future. (a) Luxations through malformations of the pelvis producing a bad coaptation of the articular surfaces (Fig. 8). (b) Luxations through an excess of flexion of the inferior member (Fig. 8). (c) Luxations through exaggeration of the obstacle which limits this flexion (eventration through umbilical hernia, retention of urine, etc.) (Fig. 9). (d) Luxation through alteration in the means of fixation afforded by the muscles and ligaments. These changes are very analogous to those which Durante has described in club-foot and which he has called plasmoidal regression (Fig. 10).

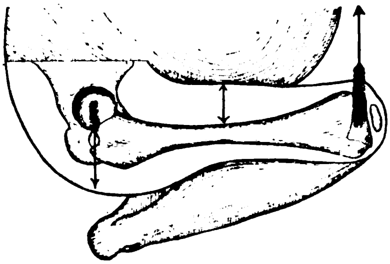


FIG. 9.—Mechanism of luxation of the hip in a case of retention of the urine in a fetus of four months.

In a word, these luxations result either from an exaggeration of the obstacles which oppose the necessary flexion of the thigh, or to a weakening of the means of union, or to a skeletal malformation.

These teratologic luxations have only been found up to the present time in the fetus born dead or nonviable. They often accompany other malformations, in particular spina bifida, and they are not rare. Relative to other congenital malformations they are even frequent—infinitely more frequent than luxations of other joints. The cause is that in all pathogenic studies of all the congenital luxations it is necessary to bear in mind the defective conditions in which this articulation is normally placed. The human hip during the second half of intrauterine life is subjected to harmful influences on account of the hyperflexion into which the hip is forced. When all the constituent elements of the articulation are normal there result only deformities which are capable of correction, but if one or more of the parts is impaired, the hip may be dislocated.

All the causes capable of producing disturbances of development, alcoholism and syphilis in particular, play a very great rôle in these teratologic luxations.

2. *Anthropologic Luxations.*—I employ this term, anthropologic luxations, to indicate that they result simply from an exaggeration of the normal imperfection of the human hip (excess of torsion of the femur, excess of flattening of the acetabulum). The higher the anthropologic elevation the more frequent is the appearance of congenital luxation of the hip.

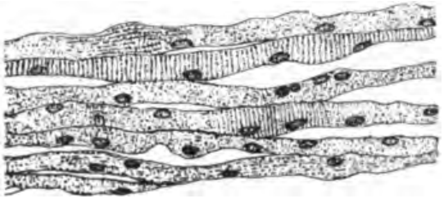
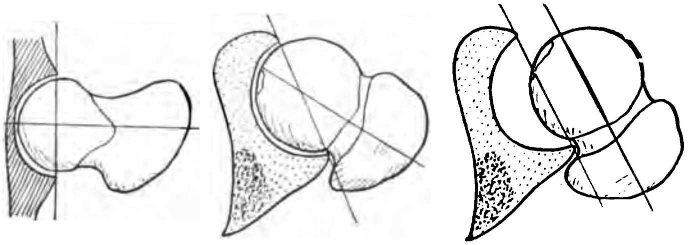


FIG. 10.—Muscular lesions (plasmoidal regression) causes of luxation of the hip.

These luxations have all the same mechanism. They are extremely frequent, and the possibility of a cure in all cases by appropriate treatment gives to the pathogeny and therapy of this difficulty a progressively increasing importance. They do not exist at birth, and in this they are completely different from the teratologic luxations which are met with sometimes and which would be met with often if they were systematically looked for.

They must not be confused with the subluxable hip of the new-born. This condition is frequent in our country. It arises when the hip being placed in flexion-adduction, a slight force applied to the knee, combined with force from within outward on the thigh, cause the head to half emerge above the posterior border of the acetabulum. The displacement of the thigh toward the flexion-abduction makes the head re-enter the cavity. A sudden spring indicates the coming out of the head. Another announces its re-entrance. This difficulty is almost spontaneously corrected in a length of time varying from several days to several months. More frequent among girls than among boys, it suggests that the predisposition of the female sex to luxation exists even before birth. It is due to an exaggerated diminution in the depth of the acetabulum. If the torsion of the femur is not too great, recovery takes place. If the femur is too much twisted this subluxable condition will be the first stage of a congenital luxation.



Bird. Fetus at term. Luxation of the hip.

FIG. 11.—Horizontal section of hip, the three subjects being considered in their normal erect position. The hip of the bird is perfect. The epiphyseal axis of the femur is perpendicular to the opening of the acetabulum. With the human fetus at term the epiphyseal axis of the femur is very much inclined, the posterior border of the neck touches the acetabulum. In the luxation the articular surfaces do not fit into each other, the neck of the femur strikes the edge of the acetabulum and the head cannot penetrate the cavity.

The defective conditions under which all new-born human hips exist explain to us why the luxation of this articulation, ten times more frequent than club-foot, thirteen times more frequent than harelip, attacks more than one man in a thousand and more than one woman in two hundred in the northwest of France.

This difficulty is five to ten times less frequent among the yellow races, ninety to one hundred times more rare among the negroes of Africa and Madagascar than in our white race. As it is entirely lacking in animals it merits the name "anthropologic luxation." It is much more frequent in the female sex, which is anthropologically higher than the male.

Some authors have deduced from the foregoing that the luxation was a malady of civilization. This is not our idea, inasmuch as the difficulty is three times less frequent in our great cities than in our country districts.

Pathogenic Mechanism.—The malformations of the femur and the acetabulum, however great they may be, only produce luxations after birth when the child unbends itself for dorsal decubitus and then for the erect posture. It is, in fact, one of the characteristics of the human species to pass from an excess of flexion in the uterus to an excess of the opposite condition after birth. The deflexion of the body completed by the lumbar incurvation is accomplished in great part in the hip. Only the phenomena which take place in this articulation interest us here.

In the normal infant in the extension of the thigh the anterior fibers of the capsule directed vertically are stretched. Supported by these, the femur untwists, while the cavity becomes hollow again. But if there is an excess of torsion in the femur, if the acetabulum is too much inclined forward, if the cavity is too vertical, and above all if these three defects are united in the same patient, luxation will be inevitable. The anatomic malformations necessary and sufficient to produce luxation after birth are: (1) An exaggerated torsion of the femur. (2) The too great inclination forward of the acetabulum. (3) A too vertical position of the acetabulum.

To explain all the details of this luxation is very complicated, but if one is content with the absolutely indispensible factors nothing is more simple. In order to render the mechanism which exists at the production of this deformity still more simple to understand we have had a jointed apparatus made representing the pelvis at the time of birth with the two femora. On one side it is easy to voluntarily reproduce the torsion and detorsion of the femur as they exist in the normal case; on the other side we can cause the luxation and make the mechanism comprehended even by persons not all conversant with anatomic and medical science. As this apparatus cannot be utilized here we will have to be content with a written explanation.

In birds and the quadruped mammals (Fig. 11) the axis of the superior extremity of the femur is perpendicular to the plane

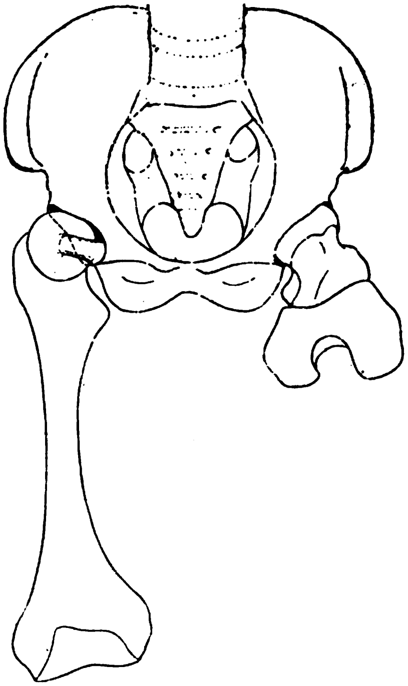
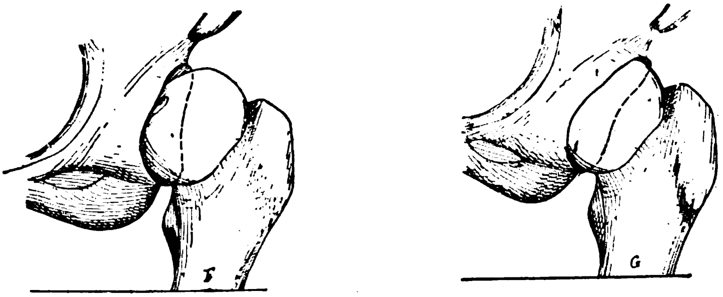


FIG. 12.—Mechanism of anthropologic congenital luxation of the hip. Prepared during intrauterine life by the torsion of the femur, it is produced in the deflexion of the thigh necessary for dorsal decubitus and the erect position. On the left, where the femur is in flexion, the head rests well hidden in the cavity. By the single action of extension one sees, on the right, the head emerge from the cavity because the femur is too much twisted and the cavity too oblique forward.

of the opening of the acetabulum. In the human fetus of four to five months the orientation is still satisfactory without being perfect, on account of the obliquity forward of the acetabulum. In the fetus at term, on account of this obliquity forward of the acetabulum, and on account of the femoral detorsion, the superior epiphyseal axis of the femur is very much inclined on the plane of the opening of the articular cavity. Let us suppose that the inclination forward of the cavity and the torsion of the femur are exaggerated so as to render the superior epiphyseal axis of the femur parallel to the plane of opening of the cotyloid cavity. This is the habitual state of affairs in the congenital luxation of the hip.

In the position of flexion of the thigh (Fig. 12, left side) the very twisted femur directs its head upward, inward and backward. The acetabulum looks downward, outward, and forward. The reciprocal orientation is perfect, and the head of the femur rests well within the acetabulum. The luxation has no reason to take place in this position, which is approximately that of the fetus in the uterus. The luxation does not take place during intrauterine life, but after birth the femur is carried in complete extension, which is necessary for dorsal decubitus and the erect standing position. The neck then becomes oblique, forward and inward. As in Fig. 11 it becomes parallel to the opening of the acetabulum. In the movement of deflexion, and before it can be completed, the posterointernal face of the neck strikes the posterior part of the acetabular border obliquely, above and outward. The entire upper extremity, pushed by the inclined edge of which it moves, is displaced from within outward in proportion as the extension is completed. The head is thus turned away from the base of the acetabulum (Figs. 11 and 12).



Boy. Girl.

FIG. 13.—The acetabulum of a boy. Very oblique below; the femoral head well fixed. The acetabulum of the girl, which is less oblique below, does not hold the femoral head as well.

In the course of this displacement the articular pressure is diminished. The relative vacancy distends the round ligament, narrows the capsule, and diminishes the depth of the cavity, the base of which is raised. At the same time the rim gives way and the insufficient cavity can no longer retain the head. All these changes are made slowly in several weeks or in several months.

By the tonic action of the longitudinal muscles of the thigh and the supplementary action of the weight of the body in the standing position, the femur, turning around, rises little by little, the head comes out from the atrophied acetabulum, and moreover encumbered by the round ligament. Newly born boys have a pelvis broad above but narrow below on account of the coming together of the ischia. The result is that here the acetabulum is directed strongly downward (Fig. 13). This orientation is favorable for giving the femur a solid support. With girls, the formation is the reverse. Here the subpubic angle is already very much widened, the ischia are more separated, and the acetabulum more vertical. With girls, therefore, the orientation of this cavity is less favorable. After birth this difference in pelvic conformation completes the predisposition of the female sex to congenital luxation of the hip.

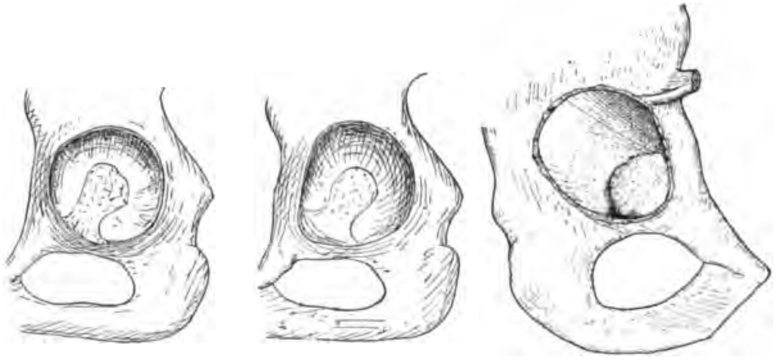


FIG. 14.—From left to right: Normal acetabulum, very slight malformation, and more marked malformation. These are the premonitory lesions of this acetabulum.

Since the luxations are produced after birth and since they occur slowly one ought to be able, by making a number of autopsies, to sufficiently observe in the course of their execution the lesions which render these luxations possible. We have been able to do so and have given to these changes the name of premonitory lesions, or preparations for the congenital luxation of the hip. Essentially they consist of the malformation of the head of the femur which facilitates the displacement, and in a giving way of the top of the acetabulum, which by the weight of the head tends to become changed into a groove where its displacement will be from the bottom upward (Fig. 14).

In many children these premonitory lesions are arrested at their very first stages and are cured without leaving any trace. With some, however, they become aggravated and end in a luxation.

Principles of Therapy.—The study which we have just made of the pathogeny of congenital luxation of the hip is thus simplified to the point of becoming almost solely geometrical and mechanical. All the other influences, anatomic, histologic, morphologic, and functional, are subordinate to these, and we do not need to describe them. They have been very well studied by our predecessors.

As far as concerns the treatment we are going to indicate in the most practical way possible the principles that ought to guide us in obtaining the greatest proportion of success. Here one finds very happily that the maximum ought to be in the neighborhood of the total number of cases. With very small children of less than three years of age congenital luxation of the hip ought always to be cured (1) provided that the articular surfaces are put in exact coaptation in such a manner that the new acetabulum exactly corresponds, center for center, to the old one. The pressure of the head will hollow out this cavity, and the movements of the head will be a still more powerful agent in the scooping-out process. If we wish to re-form an articulation it is not to immobilization that we ought to have recourse, but to motion. Function makes the organ. (2) Provided that the femur is untwisted so that the neck and the head are well oriented in relation to the acetabulum. The anatomical reason for the congenital luxation indicated in Figs. 11 and 12 will thus have disappeared. (3) Provided that the articulation has recovered its power of action and the leg is in good position. This is one of the greatest causes of difficulty in older patients and increases the period of functional restoration considerably. The restoration may even be incomplete for an indefinite time on account of the osseous or muscular destruction brought about by age.

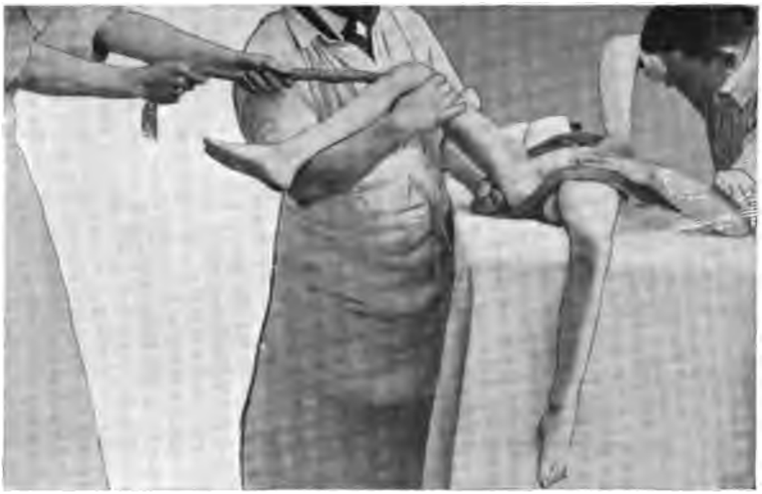
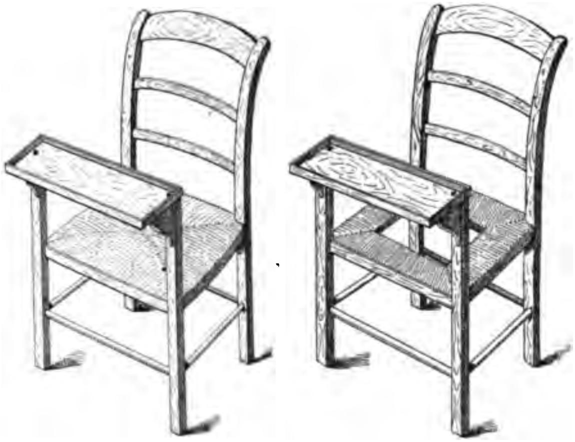


FIG. 15.—Reduction of the luxation in large children. Fixation of the pelvis with a skein of wool and an assistant. Traction on the thigh with the aid of another skein. Flexion-abduction-rotation inward and propulsion of the greater trochanter.

Reduction of the Luxation.—All the procedures are good provided they bring the head back into the acetabulum. That which we employ is only a simplification of the procedure of Paci-Lorenz. No preliminary continuous extension; no traction in extension before the reduction; no tenotomy or rupture of the adductors, but quite simply to proceed in the following manner:

Flex the thigh to ninety degrees or a little more. Make traction parallel to the axis of the thigh at the same time that the trochanter is propelled from behind forward. A rotation inward, drawing the sole of the foot toward the floor, facilitates the reduction. With large children the reduction is often an actual exertion of forces (Fig. 15). With small children it is often possible to accomplish the reduction with the fingers without any force. Here it is a good means of confirming a doubtful diagnosis.

A click, often very distinct, indicates the re-entrance of the head into its normal place, and in general the more definite this is the better the initial stability. That this stability may be good, medium, or mediocre is of no importance, but in certain cases, however, it is extremely bad, and then it must be recognized. The danger of not maintaining the head in the cavity constitutes the great difficulty of treatment.



Plain chair. Open chair.

FIG. 16.—Children with bilateral luxation are placed on these chairs.

Immobilization.—This first phase is necessary, but it must be shortened in older children in order to prevent stiffness. Three months is the maximum, two months the minimum, necessary even for older children.

It is always prudent after putting on the first immobilization apparatus to verify by the radiograph the exactness of the reduction. An error is possible even in the hands of the most experienced surgeon. It is desirable that this examination should show the diaphysis of the femur to be parallel to the line passing through the two cartilages in a Y. This general rule admits of exceptions.

During the entire duration of treatment the part will be maintained in the first position of Lorenz: flexion to ninety degrees, abduction to ninety, no rotation. In unilateral luxation the knee is only flexed at forty-five degrees in order that walking may be possible (Fig. 17). In bilateral luxation the knees are flexed to a right angle in order that the children may be less encumbered. These children spend the day in a special chair (Fig. 18) into which they are wedged in front and behind. The functional results are better in proportion as the children are treated at an early age. Many of them during the first years of life are incorrectably unclean. Some who had already been educated from this point of view lost in this respect after they had been placed in a plaster cast. We have, nevertheless, managed to render the plaster casts tolerable and to preserve them from dangerous humidity by placing under the children either a flat basin (Fig. 19) or a lattice hammock (Fig. 20).

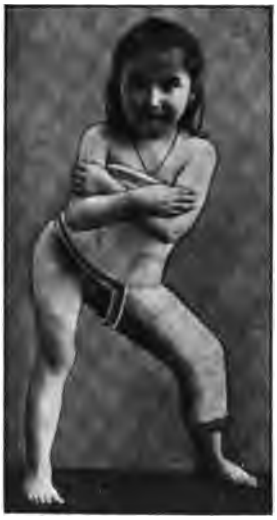


FIG. 17.—First plaster cast for unilateral luxation.

Experience has led us to continue the use of this apparatus ordinarily for three months. The purpose of this first period

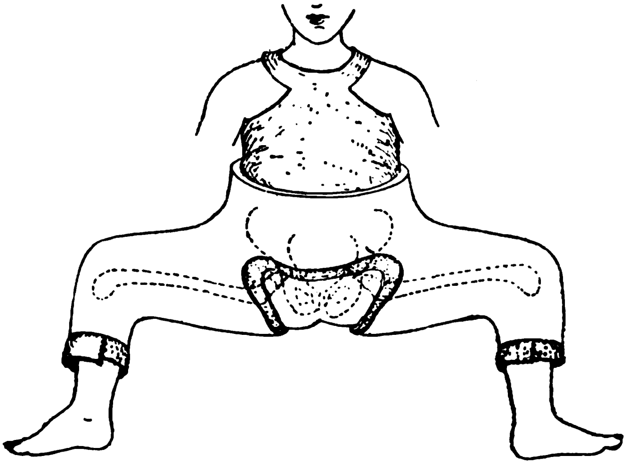


FIG. 18.—First plaster cast for bilateral luxation.

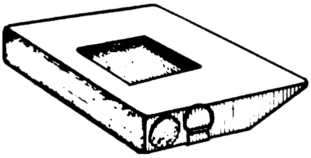


FIG. 19.—Flat basin on which the child can be laid during the night and seated during the day.

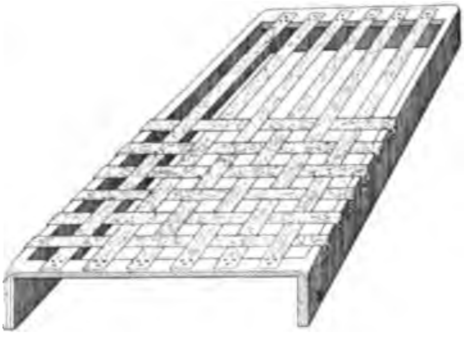


FIG. 20.—Lattice hammock. A pillow is placed under the head. A flat basin for urine and fecal matter is used. This preservation against the action of the urine is often imperfect. Nevertheless, the annoyances which result are insignificant in relation to the advantages of early treatment.

is to fix the femoral head in the acetabulum and to procure for it the support necessary for the second period.

Detorsion of the Femur.—We obtain this by the use of a special apparatus, articulated, and no more complicated than many others, but which necessitates a careful apprenticeship. Its action, which is purely mechanical, is not at all difficult to understand, and its use is sufficiently simple to make it available for any orthopedic surgeon. All orthopedic surgeons of to-day are necessarily mechanicians.

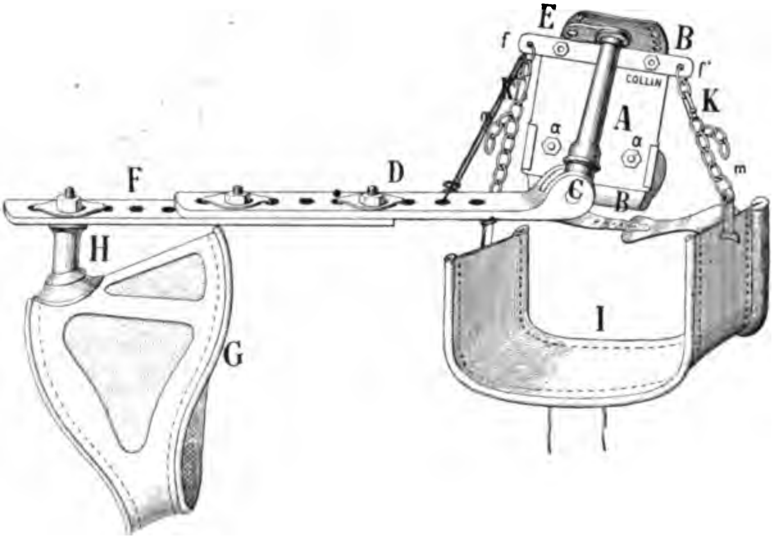


FIG. 21.—Unilateral apparatus, as it is furnished by the manufacturer.

The apparatus is composed of a plate sealed in a plaster corset. This plate carries on one side a rod terminating in a bracelet which maintains the abduction of the thigh; on the other side is a hollowed-out piece which passes under the thigh and maintains the flexion. On the support of this underthigh piece the femur will rock and attain a deformity the reverse of that which it has undergone in the maternal uterus. It will untwist. Four sizes of this apparatus exist for different ages and there are two distinct models, one for bilateral and the other for unilateral luxations.

When in place the apparatus is composed of a plaster corset made extemporaneously. While the corset is wet a plate is sealed in it which carries the other parts of the apparatus. Special precautions are taken to prevent the pressure of this corset causing sloughing over the osseous prominences. As a preliminary measure the child has been covered with eight thicknesses of cotton tricot, and on the spines of the ilium and the vertebral column pads are applied containing sawdust of tanned wood. The bracelet which encircles the lower extremity of the thigh is fixed to the end of the jointed rod, and maintains the abduction. This should remain in the neighborhood of ninety degrees. This position, combined with an equal amount of flexion, is the best to untwist the femur. The under-thigh piece will then be carried by the chains, the length of

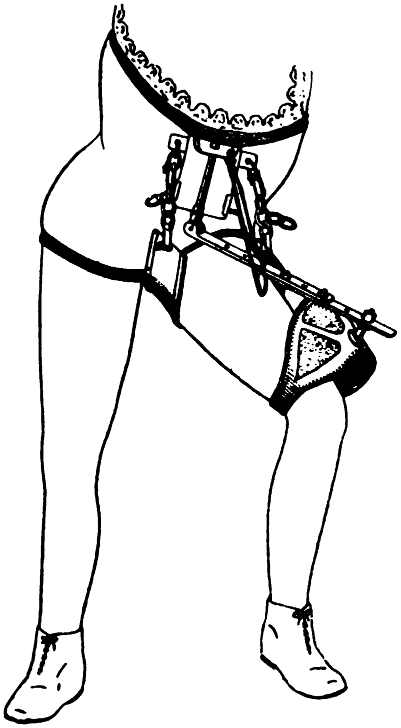


FIG. 22.—Apparatus for unilateral luxation.

which will be regulated in such a way that the flexion remains in the neighborhood of a right angle.

In attemps at walking, and in all the efforts to extend the thigh, the femur will form a lever of the first class, of which the power will be at the knee, the fulcrum on the underthigh piece, and the resistance at the superior extremity of the femur.

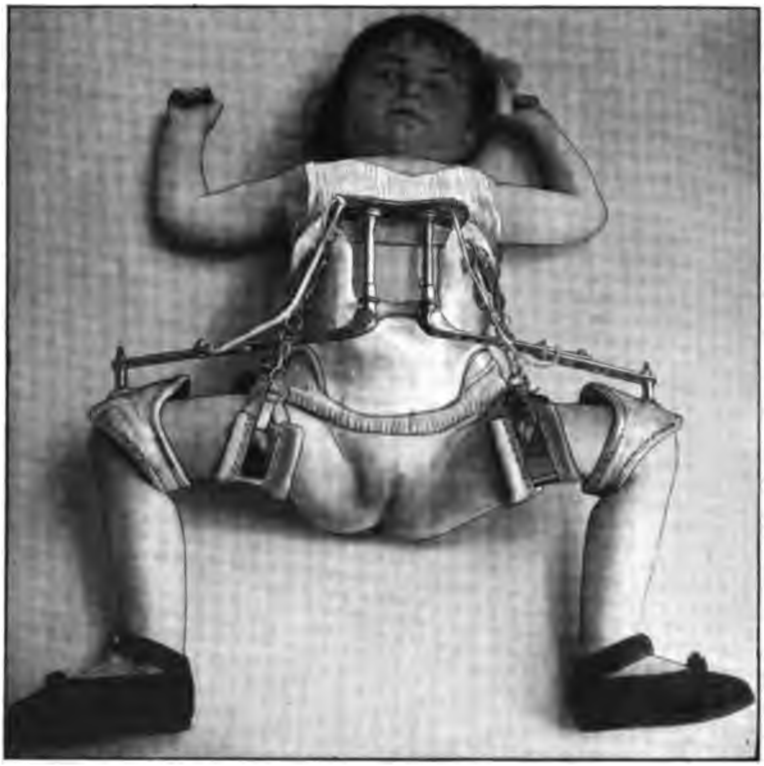


FIG. 23.—Apparatus for bilateral luxation.

There through the effect of the apparatus the epiphyseal mass will turn on the diaphysis, little by little, in a direction opposite to the first torsion. The femur will untwist. The action of walking and the different movements that one can make the child perform is completed by a continuous extension applied during the night. In children of the age of twenty-eight months at the most this apparatus is maintained for five months if the luxation is unilateral and for six months if it is bilateral. With older children the apparatus is only maintained for four months if the luxation is unilateral and for five months if it is bilateral. At the end of the treatment the apparatus is taken off without any special precaution and the child is abruptly given complete liberty.

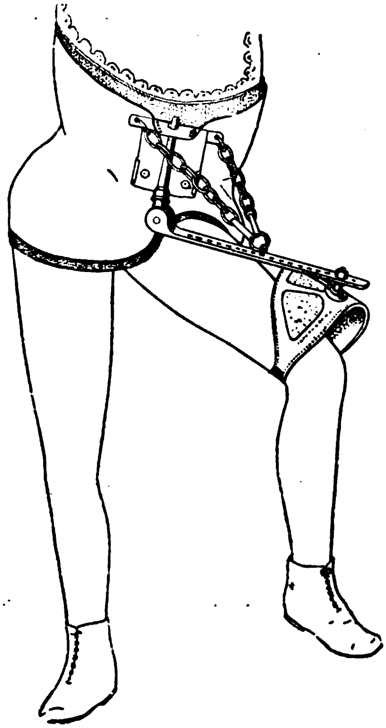
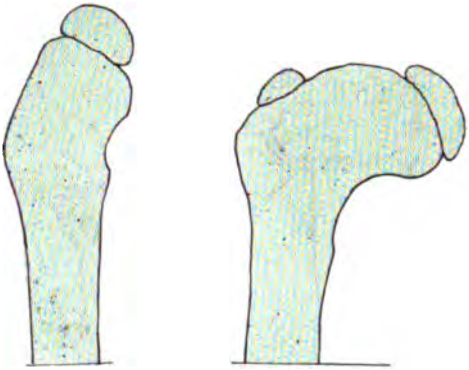


FIG. 24.—Apparatus simplified by leaving off the underthigh piece. Suitable for inexperienced operators, for very bad initial stability, and for unclean children.

Particular reasons, such as a certain degree of inexperience on the part of the operator, extreme instability of the reduction, special uncleanness on the part of the child, often make it necessary to dispense with the underthigh piece and adopt the arrangement indicated in Fig. 24. A chain stretched from the plate to the rod which carries the bracelet prevents deflexion. The apparatus is thus much simplified and its employment is easier. By wearing this a month at the most the correction is gradually brought about. The deflexion is accomplished. This is due then to the muscular contractions which in the flexion-abduction have in general a tendency to untwist the femur. The continuous extension at night is of no use, then the apparatus is arranged in this way. In whatever form it exists this apparatus has for its object the promotion of the detorsion of the femur, together with a certain mobilization of the hip. The mobilization is obtained by spontaneous movements and by forced movement. The detorsion may be produced in a slight degree by the continuous night extension, but the most powerful detorsion is determined by the voluntary contraction of the muscles. It is, therefore, indispensable that the muscles of the buttock and the thigh should be subjected to vigorous and repeated contractions. For this object the best exercise is walking: the treatment is essentially ambulatory. When this is impossible, as in the case of small children with bilateral luxation, they are placed on the stomach and allowed to amuse themselves in that position and to move about with the aid of hands and feet. Only immobility in a



Femur much twisted. Femur well untwisted.

FIG. 25.—Radiograph of a very much twisted femur, seen before treatment, and of a femur untwisted after treatment. These two radiographs are taken through the anterior aspect.

chair consitutes a loss of time and exposes the patient to a setback. The chairs represented in Fig. 16 should be forbidden during this second stage. They immobilize the child too much.

Radiographic Study of the Detorsion.—The radiograph alone permits us, I will not say to measure, but to determine the detorsion. If we wish to make a complete study on the living subject the task will be very complicated, but in practice it can be much simplified. It is sufficient to compare two radiographic tests, one made before the reduction of the luxation and the other six months after the completion of treatment. For the two plates the child is placed in two exactly similar positions, symmetrical dorsal decubitus, with the legs hanging straight down. Before the treatment the shadow of the femur appears very little bent because the head is in anteversion. Its form recalls that of an I. After treatment the anteversion is corrected, the neck is almost parallel to the radiographic plate, the shadow of the femur recalls the form ⅂ (L turned about). It is very strongly bent.

In actual practice torsion and detorsion are sometimes more, sometimes less clear. This simplified proceeding has the advantage of not obliging one to take any supplementary radiographs.

Functional Restoration.—In all the methods of treatment it is the longest and most tiresome with children who are a little grown. We are only considering here the cases where an anatomical cure has been obtained. With little children this functional restoration is accomplished quickly and well. The abduction with apparent lengthening persists for a very long time, for several years. The articular stiffness diminishes with extreme slowness in spite of the voluntary motions and active and passive gymnastic exercises which are carried out. It is sometimes even necessary to promote the drawing together of the knees, sometimes by continuous extension and sometimes in other ways, but it is always necessary to proceed with gentleness and patience and to be content with diminishing the distance a few centimeters each month.

In the course of this long period of progressive improvement it is rather frequent to see attacks of pain with contracture and articular stiffness simulating arthritis. With time and the adjuvant influence of complete or relative rest these attacks disappear in a few days, weeks, or months.

We can divide the convalescence, the period of restoration to function, into three categories. (1) Convalescence which is short and regular, almost constant, in young children, where the flexion and abduction gradually diminish and disappear in a length of time which varies ordinarily between three and fifteen months, where the motions of the articulation recover in approximately the same time. A perfect gait is obtained ordinarily in a time varying from six months to two years. (2) Convalescence which is prolonged and irregular, where the phenomena of stiffness and apparent lengthening are still more slowly corrected. This stiffness is somewhat exaggerated by the appearance of attacks of pain with contracture in the affected articulation. Two, three, sometimes even five years, may be necessary for a perfect restoration of function. This slowness of recovery comes from a single cause, the age of the child. (3) Convalescence which ends in an incomplete restoration of function. Peculiar to large children, it proceeds as in the foregoing cases, but in spite of all supplementary treatment the restoration to function does not become complete. There finally remains a claudication through muscular insufficiency and articular stiffness. These incomplete functional results always have for their cause malformations and lesions due to age. It will be necessary then in certain older patients to be content with simple functional improvement.

Accidents and Complications.—The treatment that we employ, like all others, does not shield one from accidents. With careful supervision, however, the greater part of them can be avoided. The most frequent are (1) the sloughs that one can detect by constant supervision. (2) The re-luxations in the apparatus, which one can prevent by proper adjusting and regulating the apparatus. (3) Fractures either during the reduction or in the second apparatus. These are almost always avoided by recommending incessant watchfulness on the part of the parents.

The late re-luxations are seen in one case in ninety, and always during the first six months of convalescence. If the children are very young a second course of treatment, somewhat prolonged, ordinarily brings about recovery.

The anatomic results secured by the treatment have to their credit about 97 per cent. of cures. The exact and definite repositions are just as frequent in the bilateral luxations as in the unilateral and in large children with reducible luxations as in the little ones. The relation between the anatomic results and the functional results may be summed up thus: (1) Without perfect anatomic correction there is not absolute functional cure. (2) Anatomic correction procures for all the very little children integral functional recovery. (3) In spite of perfect anatomic recovery judged by the radiograph the functional restoration may remain incomplete in large children. The articular stiffness and muscular insufficiency are the habitual causes of these incomplete results. All other things being equal, they are proportionately more frequent as the children are older. Their prophylaxis rests in early treatment.

In this rapid review of the mechanism and treatment of congenital luxation of the hip I have made no pretence of giving anything but a very general sketch for the purpose of showing the very great and varied interest which is presented by the causes of this difficulty. I consider it as a price paid for the anthropological elevation of the human species. I should consider myself well rewarded if the therapeutic ideas which I have briefly set forth should give some reader the desire to employ the very simple method that I recommend, and which is so constantly perfect in its anatomic and functional results provided the children treated are very young.

XXXVII.

THE CAUSES AND TREATMENT OF SCOLIOSIS.

BY Z. B. ADAMS, M. D.,

Fellow in Anatomy, Harvard Medical School; Assistant Orthopedic Surgeon, Massachusetts General Hospital.

From a careful study of the radiographs, it at once becomes apparent that in a large per cent. of the cases, scoliosis is due to a congenital deformity of the sacrum or last lumbar vertebræ.

Sir William Turner has pointed out that in 5 per cent. of all subjects the inferior articular process of the fifth lumbar vertebra fail to fuse with the vertebral body. The same anomally more rarely occurs in the fourth lumbar vertebra. Defects of the superior articular processes of the sacrum are frequent. One of the pedicles, in rare cases, fails to join the body. Neural processes are at times absent, and the articular process of one side shows marked overgrowth or undergrowth.

Due to such cause, a one-sided spondylolisthesis, slipping forward of one side of the fifth lumbar body on the sacrum, may occur, or the fifth lumbar vertebra may be tilted backward on one side.

In other cases there is a rotation between the upper segment or segments of the sacrum before they fuse. The articular processes between the sacral segment are the only elements which prevent such a rotation and in the sacrum they are primitive.

The lumbar and thoracic curves are the results of maintaining equilibrium upon this tilted base.

Any treatment directed solely against the thoracic and lumbar curves is bound to fail in producing permanent correction, unless operative procedures are adopted to secure a stable base on which the spine can rest in equilibrium.

F. N., girl, fourteen years old; no history of injury; no other case of scoliosis in the family; curve first noticed one year ago; has been under treatment nine months in rotary jackets advised by Dr. A. MacKenzie Forbes of Montreal; marked improvement has been obtained in both the lateral and rotary deformities.

The case presents a right lumbar left dorsal scoliosis, with rotary deformities.

Tracing from radiographs show a bifid spinous process of first sacral segment. The right articular process of sacrum is anterior to the left articular process. This allows the fifth lumbar vertebra to rotate to the left, pivoting on the left articular process of the sacrum. As the right side of the fifth centrum swings forward on the sacral facet, there is a downward movement due to the inclination, forty degrees, of the top of the sacrum. The fourth lumbar vertebra is rotated to the right. The epiphysis of the iliac crests to which the ilio-lumbar ligaments are attached have not yet united.

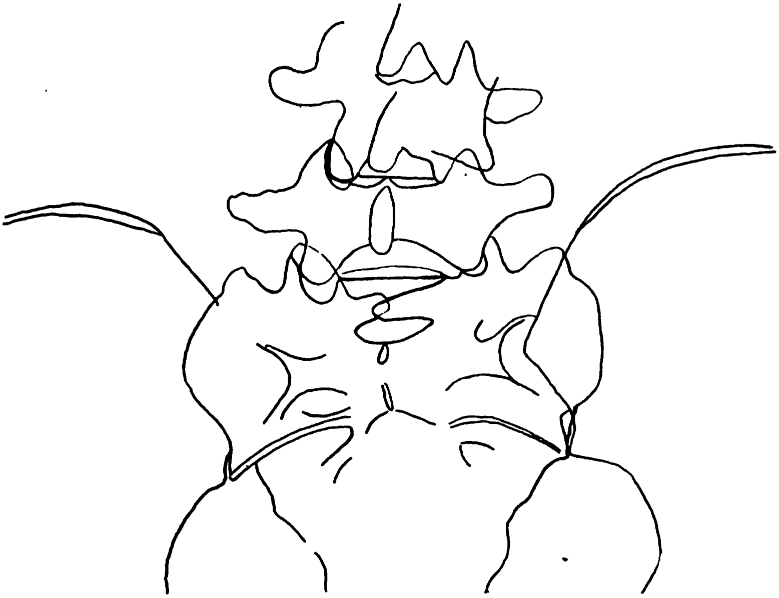


Fig. 2.

Correction in this case can only be maintained by drawing back the right side of the fifth lumbar vertebra and fastening it in normal position by operation.

XXXVIII.

CONCERNING THE TREATMENT OF SCOLIOSIS.*

BY A. SCHANZ, DRESDEN.

The debate concerning the treatment of scoliosis is the *bête noire* of the Orthopedic congresses. Wherever orthopedic surgeons are gathered together to discuss scientific questions, there is certain to be an argument about the treatment of scoliosis, and this argument is certain to end in the same typical way; some young colleague in the orthopedic practice steps forward and announces with scientific enthusiasm, that he has, by means of some new curative process, obtained successes in the treatment of scoliosis such as up to that time had never been obtained. He promises that by the correct and timely use of this means to free mankind from the scourge of scoliosis.

However great is the enthusiasm of the speaker, it is not greater than the want of it in his audience. In the ranks of the old guard, among the gentlemen who have worried themselves with the question of scoliosis, there is an expression of pitying pardon. But then—all these men have once stood on the same place from which the speaker to-day delivers his oration. They spoke on the same subject and the high horse which the present speaker rides, looks the same to a hair as that which they once so proudly rode. Is it anything to their discredit when they harbor doubts as to the capability of the gray, which is being broken in to-day, to jump better than the bay and the black which they once paraded?

Taking one thing with another the old doubters have been in the right mostly. *Every time that fresh hopes have been aroused, just so often has the disappointment followed.* It is to be wondered at, therefore, that we, who have been through a considerable number of orthopedic congresses, fear the scoliosis debate?

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* Read before the International Congress in London, Aug., 1913.

In spite of this, the Orthopedic Section of the Seventeenth Medical Congress again reserved a whole session for the subject of scoliosis treatment. That has certainly not been done in the hope that the solution of the old riddle will be found to-day. *The purpose which directed this action of the Congress directors is probably to urge us on again and that with the greatest authority, to combat with the problem of scoliosis*, to an attack on that problem which has occupied orthopedic science for the longest time, that problem which has shown itself to be the most difficult to solve of all that have ever beset our science and our art.

When the directions of the Congress invited Dr. Lovett and myself to introduce to-day's discussion with our papers, and to point out the direction and aim which the discussion should take, they laid upon us an exceedingly honorable task, but also one which was fraught with many difficulties. Particularly difficult because it compels us, in comparatively small space, to treat a question and to take up a standpoint of it, when the literature concerning the question takes up a whole library. Still more difficult, however, because the danger threatens us that to-day's debate will take on the same course as its predecessors and that it will be just as fruitless as they were.

I consider the danger that straw will be threshed in our discussion to-day, which has already been threshed a hundred times, to be very great. We shall only escape this danger by giving our discussion a different beginning and setting it a different object to the one pursued up to the present.

I am not in a position to announce to you gentlemen, an up-to-the-present unknown certain remedy for scoliosis. To present this gathering with a sort of bird's-eye view of how scoliosis is treated here and there has, according to my idea, no use, for everyone of us knows it; at least he can and should be in possession of this knowledge. I also hold the critical comparison of the competing methods or the publishing of successes obtained personally to be as little to the purpose. Our discussion can, however, be very useful, if we do not bring before our own eyes and those of the world what wonderful progress we have made in the treatment of scoliosis but only then, when we make certain of what we have not attained to up to the present. Our discussion can be of use when we investigate what can and must be regarded as attainable in the treatment of scoliosis and when we look for the reason why we have not attained the attainable. We must provide ourselves with a compass which will show us our path in the land to be explored. The great discoveries which our time has to show in all departments of medicine allow us to hope that when we have such a compass, the discoverer will find the passable way. In my paper, therefore, I set myself the object of showing what the present-day treatment of scoliosis does not perform and to investigate what may be regarded as attainable in the not attained. A further object pursued is the seeking for an explanation why our endeavors up to the present have only been able to show partial success and I should finally like to find out some bearings which would enable us to recognize the path of possible progress.

When, gentlemen, one scans the history of the treatment of scoliosis, one remarks quite a peculiar activity in experimenting. The most different propositions of treatment, the most varied experiments follow upon and run parallel to one another. They do not occur under the motto of the development of the various methods, but always as new solutions of the whole problem starting from first principles. And at the same time the various writers contradict each other in the bluntest manner. The most extreme proposals are published, proposals which leave room to doubt the sound common sense of their authors.

This sort of tihng is only possible in scientific work when the sure and certain basis is wanting. Where there is a firm foundation of facts the most different intelligences will come to conclusions which will show a certain conformity. Where this common foundation is wanting, everyone's fancy is given the greatest play and it is not to be wondered at when many a man, not otherwise given to such a game, propounds the wildest theories.

That the laying down of a firm foundation, upon which a rational therapeutic treatment may be built up, has been neglected, is, gentlemen, probably a statement, which, in our circles, may cause not a little astonishment and yet, it is quite easy to prove this statement to you.

The great progress which medical science has made in recent times is based upon the fact that we have broken away from the old symptomatological division of diseases and have in its place an etiological one—a division based upon the natural relations. The whole progress which natural science has made in recent times also is based upon the fact that one searches for the causes of natural phenomena. A drastic example: it was not until we had learned to group the plants according to their natural relationships and not according to Lenne's system that there has been a modern botany.

In the case of scoliosis, however, we are still in the antediluvian time of the symptomatological disease system.

Take for example the orthopedic text-book which has been more widely read than another such: Hoffa's Lehrbuch der orthopädischen Chirurgie, and you will find the following division of the deformities of the spine: sagittal anomalies in the carriage, with the subdivisions—round back, chronic spinal inflammation, rhachitic kyphosis, and saddle back. There follow: Spondylitis and spondylarthritis, tuberculous, traumatic spondylitis and then comes scoliosis with the divi-ions: habitual scoliosis, rhachitic scoliosis, static scoliosis, congenital scoliosis, collar bone scoliosis, scoliosis following empyema and neurogenic scoliosis—(a) the paralytic scolioses, (b) the hysterical scolioses, the traumatic scolioses, the rheumatic scolioses, the neuro-muscular scoliosis, ischias scoliotica.

The system, gentlemen, which Hoffa here presents to us is the most absolute lack of system. The nearest relations are separated by the greatest gaps, and the most foreign elements are grouped closely together.

It is almost incomprehensible that this sort of thing could occur in a modern medical text-book. It can only be explained by the fact that the decisive step away from the symptomatological observation and division of diseases, has not yet been taken. Still another thing, gentlemen, it is not there a question perhaps of the peculiar incompleteness of Hoffa's text-book, but rather the mistake, which I could show you in such a drastic manner and which is to be generally found to-day in all the orthopedic text-books. Schulthess, who worked out the chapter on scoliosis in the Joachimsthal Handbook of Orthopedic Surgery and who certainly claims to be a modern writer in the sphere of scoliosis, expresses himself emphatically in favor of retaining the symptomatological classification of the spinal curvatures and rejects emphatically the claims of the etiological division.

Now, gentlemen, we shall probably admit without contradiction that this system of classifying the deformities of the spine is obsolete. You will probably, however, inform me that it is hardly possible that an error which could have a crippling effect on the whole science of scoliosis could be contained in it. You will perhaps emphasize the fact that for orthopedic science, which is principally engaged in the treatment of deformed bodies, a classification of the diseases according to the external symptoms, that is a symptomatological disease system is the most suitable and could hardly be dispensed with.

Certainly, gentlemen, the old garment which is the garb of orthopedic science, has been tinkered together just as the pieces best fitted and just as this costume has become in this process of manufacture we have come to get used to it and to like it. But we must throw it off if we desire to become up-to-date men in orthopedic science and especially in the therapeutics of scoliosis, if we desire to reach the summit which modern medical science has attained in other departments.

As long as we treat in our text-books, habitual scoliosis, congenital and paralytic scoliosis and ischias scoliotica in the same chapter because the spinal column shows a curvature to the side in all these deformities, so long, gentlemen, will we be unable to avoid conclusions, deduced from one or the other of these diseases and carrying them to others, conclusions which in the one place were perfectly correct, in the other, however, totally false and misleading.

Anyone who eats chocolate and cheese from the same plate will never be quite clear in his mind as to the real taste of chocolate and cheese.

In this fact, gentlemen, that we have not yet got past the symptomatological classification to a rational system, in this fact is to be found the cause of the confusion in the field of scoliosis therapy, and that is the heaviest fetter which has hindered the advance of the progress of scoliosis therapeutics. Therefore, if we desire to carry on a useful discussion, it is absolutely necessary to effect a clearance first in this place.

We must begin by fixing the term scoliosis.

Here we will not speak of all diseases which show a lateral curvature of the spine. When the direction of our congress set the subject of the treatment of scoliosis they did not intend that the therapeutics of all those diseases should be discussed in the symptomatology of which a lateral curvature of the spine is given, just as little as we orthopedic surgeons, when speaking loosely of scoliosis think of the whole collection which Hoffa, for example, gives us under this definition.

In practice, gentlemen, we have set up a definite conception of scoliosis, let us carry this out in theory also and seek to find a sharp scientific definition.

What do we orthopedic surgeons understand by scoliosis.

Diseases in which alterations in the skeletal structure occur are named by us orthopedic surgeons "scolioses."

Now what is characteristic about these skeletal alterations? Infinitely much. It will suffice, however, to take a few pregnant examples. I will choose such as are particularly conspicuous and which are especially peculiar and I shall only put so many together that a symptom-complex occurs which will suffice for a definition of the concept.

The first thing which one notices in all three skeletons is, that the spinal column is laterally curved out of shape.

This curvature, however, is not a simple one. Instead we have besides the great curvature, which we utilize for giving the designation, *e.g.*, right convex dorsal scoliosis, also two slighter curvatures in the opposite direction, the upper and the lower countercurvatures.

If we regard the single vertebræ we find these also regularly repeated, conspicuous divergences from the normal form. I will not describe and will not show diagrams of these alterations as you know them as well as I do. I will only name them. We find then in the spinal column of our third diagram in a definite place wedge-shaped vertebræ, oblique vertebræ, and vertebræ between these two types.

As a further regular and exceedingly characteristic part symptom of our scoliosis skeleton we see the torsion which expresses itself in the spinal column as a whole, in the wedge-shaped and oblique vertebræ and in the ribs with the unconditional regularity of a law.

Enough of that! The part symptoms named here we find in every case of real scoliosis. They are so peculiar and characteristic in their construction that they suffice for the definition of the conception scoliosis.

All real scolioses, gentlemen, show these symptom-complexes; lateral curvature of the spine with formation of principal and countercurvatures, with cultivation of wedge-shaped and oblique vertebræ and torsion. And if we turn this sentence round, then we have the means of settling whether a lateral curvature of the spine is to be spoken of as a real scoliosis: A deformity where we have a complex of various curvatures of the spine in various directions, where we have the cultivation of wedge-shaped and oblique vertebræ and vertebræ between these two, and where we find the characteristic symptom of torsion, that, gentlemen, is a real scoliosis. Where these recognition marks are not present, where only one is missing, there we have not a real scoliosis, even if one case otherwise is as like another as two eggs.

If we now cast a glance over the deformities which are commonly known under the name scoliosis and see which among them we can admit as real scolioses and those which we must reject from the scoliosis chapter.

If we now keep to Hoffa's text-book, we shall recognize the habitual and the rhachitic. We may also add a number of scolioses which are not mentioned in Hoffa's book, *e.g.*, if it is to be separated from the habitual, then the constitutional scoliosis, then the osteomalacic and the osteopsathyrotic. I have shown preparations of the last two at the fourth Congress der Deutschen Gesellschaft für orthopädische Chirurgie and demonstrated the characteristic forms of the real scoliosis on the same. Also the stone carrier's scoliosis described by Golobiewski and the apprentice's scoliosis described by myself are real scolioses.

We cannot, however, recognize the congenital as a real scoliosis. However similar in its exterior form it may be to those, yet the congenital deformities on which the congenital scoliosis is based do not belong here to our symptoms.

Collar-bone scolioses are just as little to be considered real scolioses; they are very nearly related to the congenital.

The cicatricial, that following empyema, the hysterical, the rheumatic, the scoliosis ischiadica you will allow me without discussion. Also the traumatic scoliosis of Hoffa you will permit me to discard.

There now remain only the static and the paralytic scolioses. Now comes a difficulty. We know static and the paralytic scolioses as fixed and unfixed form. In the case of the unfixed form we have no wedge-shaped and oblique vertebræ and no torsion. In the case of the fixed form these are all present, and also curvatures and countercurvatures.

Here when carrying out our classification, we should have to recognize the fixed static and the fixed paralytic scolioses as real scolioses but we should have to reject the unfixed forms. Would that not be an unnatural separation of disease complexes which should go together? Would my natural system not by this means be reduced to absurdity?

Allow me, gentlemen, to postpone the answer to this question. I will answer you as soon as I have presented my opinions as to the origin of the real scoliosis.

We must also have a definite picture before us as to the origin of scoliosis if we are to follow a consistent system of therapeutics and we must come to an agreement about this picture before we can begin with the discussion of therapeutics. To quote a few examples, when one attributes the origin of scoliosis to a disturbance of the equilibrium of the tone of the back muscles, another to a disturbance in the development of the embryo, a third in a statical overweighting, a discussion of therapeutics is, in the nature of things, quite impossible. Each of the three would on principle make different proposals and would endeavor to explain the results by his own opinions in this way or that.

For this reason, gentlemen, we do not dispense with the necessity of engaging ourselves with the etiology of scoliosis, with this we come to a chapter to which an enormous quantity of ink and paper have been sacrificed, without any unanimity having been arrived at. At the same time this question is comparatively easy to answer and with a certainty which is exceptionally rare in medical questions. We can solve the question after the etiology of scolioses with the help of mathematical, or more correctly physical calculation and that on this basis:

As long as there has been an investigation of scoliosis, those engaged in the research after the cause of the deformity have continually had the impression forced upon them that the weighting of the spinal column must play some part in the etiology of scoliosis.

Scoliosis has been classed under the weighting deformities as long as the conception of a weight deformity has existed. Only we have not yet quite found out how the weighting has a deforming effect and what factors of the weight which otherwise is borne without injury by the spinal column give this power to deform.

Here we can come in with physical calculations, by reckoning out under what conditions and to what forms are columns deformed by weighting when they stand under the same conditions as the spinal column in the human body. If these calculations give us pictures which correspond to the characteristic form alterations in the case of the formation of scoliosis, we can, indeed we must, take it that these alterations in the form of the spinal column have arisen according to the same general laws, upon which we have based our theoretical calculations, that these alterations are nothing else than the expression of the work of physical forces.

I will not lay these calculations before you to-day, gentlemen. They were carried out by me and published in the literature. I direct special attention to my monograph: "Die statischen Deformitäten der Wirbelsäule mit besonderer Berücksichtigung der kindlichen Skoliose," which appeared in Stuttgart in 1904, published by Enke, as well as to the paper by me at the fourth Congress der Deutschen Gesellschaft für orthopädische Chirurgie and entitled "The Mechanics of Scoliosis." When working out my present paper I have gone through the figures given in the papers mentioned and find that I can maintain them in every particular.

In referring shortly to those works, I must content myself with giving the premises upon which I based my calculations and the results to which they led.

One of the most important functions of the spinal column is the task of supporting the weight of the head, the trunk, the upper extremities and accidental burdens. A corresponding strength is given to the spinal column for the fulfilling of this function: its bearing power or static strength.

The spinal column fulfils its task of weight carrying without any injuries as long as bearing power and load are normal, or more cautiously expressed, as long as the load and the bearing power are in correspondence as to their quantity; as long as the weight equilibrium on the spinal column exists. If this weight equilibrium is disturbed, then injuries to the spinal column must occur, just as any other organ in our body suffers injuries when specific functions are demanded from it to a greater degree than its ability to perform them; the overstrained eye becomes short-sighted, the overstrained ear becomes a little deaf, the overstrained heart becomes insufficient, etc.

When the spinal column falls under the influence of a burden which is too great for it, injuries must arise and they are of the same kind as hold good for the overweighted bearing column generally. The relations between the spinal column and its load are naturally subject to exactly the same laws as those between any other column and the weight resting upon it. Whether a column stands in the living human body, or in a house, or in the construction of a bridge, the relations in every case are governed by the same primary laws. Every such column becomes injured on being overloaded and these injuries are the same with the uniformity of natural laws. They only show variations caused by the particular properties of the different pillars, *e.g.*, greater or less flexibility, elasticity, breaking resistance of the material of the column.

The circumstance that the human spinal column forms part of a living organism does not abolish for it the general laws of the loaded column. We can only condition a difference as against column of so-called dead material in the fact that the living organism is capable of accompanying the sequence of the processes which result from the overloading of the spine according to physical laws, with signs of life—with reaction symptoms. We may expect with the greatest probability that such reactionary symptoms really do occur, because the living organism replies to all influences which are injuries and dangerous to it with reactionary symptoms.

We must, therefore, have two kinds of alterations if scoliosis is a result of misproportion in the loading; first such as are conditioned by the accommodation of the bearing power and the load, and secondly those which accompany this play as the reactionary symptoms of the living organism. This admission is an exceedingly important determination of the pathological state. The two groups are distinguished by the fact that we can calculate the symptoms of the first group according to the laws for overloaded columns while in the case of the second group this is impossible.

Of the results to which one comes finally in the carrying out of this calculation, I should like to quote a few particularly important ones and I select such as are in connection with the symptom-complex which I gave as being characteristic for the real scoliosis.

The occurrence of a combination of principal and counter-curvatures is conditioned by our spinal column being, with its end sections, confined to the plane of the floor and the plane of sight; a loaded column with its end sections bound to horizontal planes, in the case of overloading, bends with the production of a principal and two countercurves.

The torsion is explained by the fact that the spinal column is composed of a series of bodies and of curves. The series of curves rests on the series of bodies just like a reinforcement band on the periphery of a column. In a column so reinforced the overloading first comes on the point on the periphery opposite to where the reinforcing band is, and lastly where the band is attached. The bending due to overloading is, therefore, felt at different times at different points of the cross-section of the column. Consequently arise its twisting motions, which we, in the case on the scoliotic spinal column, describe as torsion.

Wedge-shaped, oblique, and intermediate vertebræ are also formations conditioned by mechanical laws. If we cut a bent column into pieces corresponding to the vertebræ we find the typical signs in these of those vertebral alterations.

Why, gentlemen, have I mentioned to you these calculations and quoted to you their results?

Because these calculations must remove every doubt as to the cause of the origin of scoliosis. Where the results of calculations and observations on the single object so agree as they do here, there can be no objections and doubts that this object is an example of the application of natural laws. With those who do not agree to this it is as impossible to discuss the question as it is to discuss the correctness of a mathematical calculation with one who does not recognize the axioms of mathematics.

Now, gentlemen, you must allow me to take a few examples from the group of reactionary symptoms of the living organism. They are important for many questions of therapeutics.

Analogous with other diseases we may expect that, in the case of the occurrence of any overloading conditions in the spinal column, the living organism will draw the attention of the patient to the fact that there is something wrong with the machinery of the body.

We may further expect the body endeavors to defend itself against the injuries and to repair the damage already done.

To the first group, to the signs with which the organism draws the attention of the patient to the danger, to the signal symptoms belong the pains in the back, which are mentioned in our text-books for the early periods of scoliosis and the intercostal neuralgia of the old severe scoliosis. Here also are to be included all the symptoms which I have gathered together under the title of insufficientia vertebræ.*

Thus the sensibility to blows in the line of the spinal processes, the sensibility to pressure in the bodies of the lumbar vertebræ, the senbility to pressure of the intercostal nerves, the sensibility to blows of the sternum, etc.

The importance of these evidences of insufficiency for prognosis, indications for treatment and therapeutics make it necessary to draw attention to them here.

I will not go into the group of defensive activities which the body is capable of developing against the formation of scoliosis. I will only mention they exist and have been described in my above-mentioned works.

Corrective appearances are unknown up to the present. They must, however, sometimes occur as otherwise the spontaneous correction of scoliosis which in the lighter cases is sometimes doubtless to be observed could not happen.

At this point I should like to cast a short look back. The ground upon which the building of therapeutics is to be erected has been laid with what I have already said.

I recapitulate: The real scoliosis is a deformity of the spinal column arising in the postfetal life.

Its characteristic symptoms on the spinal column are: in the first place the formation of a complex of principal and countercurvatures, second, the formation of wedge-shaped, oblique, and intermediate vertebræ and third, torsion.

Scoliosis arises on account of a disturbance of the weight equilibrium on the spinal column, the characteristic of which is, that the static demands exceed the static ability.

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* A. Schanz, Ein Typus von Schmerzen an der Wirbelsäule. Verhandl. der Deutschen Ges. f. orthop. Chir., 1907. Insufficientia Vertebræ und Scoliose, Berlin klin. Wochenschr., 1908, No. 43.

The pathological appearances which arise on the formation of scoliosis form two vitally differing groups: first, the appearances resulting from the play of mechanical forces, second, the group of reactionary appearances with which the living organism accompanies the disturbance on the spinal column.

We will treat one more question, gentlemen, before we go on to speak of the treatment of scoliosis and that is the practical significance of scoliosis.

I have just mentioned to you quite a number of real scoliosis forms: the habitual, the rhachitic, the osteomalacic, the osteopsatyrotic, stone carrier's and apprentice's scoliosis and this list may, as I have already said, be considerably lengthened.

Of all these forms of scoliosis, those arising in youth are by far the most important practically as compared with all the others, so much so indeed that we in practice by scoliosis understand loosely only the youthful forms: that is the rhachitic, the so-called habitual with its subform, the constitutional and the form which I have described as apprentice's scoliosis.

These forms which show a certain uniformity and which we can class together under the general term youthful scoliosis are the ones which take up the greater part of our attention in the practice and which again should be described among the real scolioses by our present subject of discussion.

Where it is not emphatically otherwise stated when I speak of scoliosis I have in my mind this youthful scoliosis.

The practical importance of the single forms induces me, however, to undertake a further important classification of the group of youthful scoliosis.

A serious scoliosis is a great injury to the person afflicted with it. The deforming of the body, the injury of the whole organism, the limitation of the power of work, and to enjoy as compared with the pleasures of life all of which are accompaniments of a serious scoliosis make it a very, very, heavy burden. The wide distribution of scoliosis gives it, however, also a great social importance. The strength of a people will be severely handicapped if a large number of its natives are afflicted with scoliosis.

To draw attention to the imperilling of the single person, to the imperilling of the nation by scoliosis is the first duty that we orthopedists have to fulfil in the combat against scoliosis.

However, one thing I should like to point out with all emphasis and that is, in pointing out the dangerous nature of scoliosis we must at all costs avoid any exaggeration.

In Germany and also in many other countries the school children have been examined for cases of scoliosis and very high figures were found up to 80 per cent. scoliotic children. From this one came to the conclusion that the strength of our nation was severely endangered by scoliosis.

The conclusion, gentlemen, was an enormous exaggeration. I have proved that from our recruiting statistics. The kingdom of Saxony in which I exercise my activities is, according to the cripple statistics, that part of Germany which has the most cases of scoliosis. In spite of this at the time of recruiting only 1/2 per cent. were rejected on account of scoliosis and here where Germany has such a great surplus of recruiting material a very, very sharp lookout is kept for scoliosis. If we have 80 per cent. scoliosis school children, there can only be a very small percentage of these, putting it at a very high figure, say 2 per cent. to 3 per cent., which could be of any importance. In spite of this, of course, scoliosis remains a very serious disease and the health of our people is heavily enough handicapped by it.

We orthopedists, however, must learn one thing from these figures and for this reason I have quoted them and that is, not every young person by any means who suffers from scoliosis runs a serious danger.

Among the youthful scolioses we have such which never become of serious importance and at most attain the dignity of a blemish to the beauty of the body, and which generally disappear without any treatment when the youthful body ripens into adolescence.

I should like to name these light scolioses in distinction to the malignant ones, which grow in rapid strides until they become great deformities and injure the whole personality for the whole life in the most serious manner. These malignant forms—I should like to emphasize this, in order to correct a widespread error—do not come to a standstill approximately with the end of growth of the body, but become through the whole life increasingly worse.

The proportion between the mild and the malignant scolioses is really favorable as I have already hinted above. In my practice where it is, of course, different to the school and recruiting statistics, I find, for ten mild scolioses only one malignant one.

If, gentlemen, it is our first duty to draw attention to the danger of this disease for the single patient and for the nation, then it is our second duty to point out the differing importance of the mild and the malignant forms.

In the cases of ten children brought into our consulting room on account of scoliosis, it is a pleasure for us and a relief for the parents of the patients that we can say that the child will never suffer any serious harm from the scoliosis and that fears have been entertained which were groundless. Not until then does one come where the answer must be quite different.

It would be a great pleasure for me to go into details how to distinguish the mild from the malignant form of scoliosis. I should then come to a question which has by no means been generally cleared up. It belongs, however, to the chapter on the diagnosis and I must, therefore, deny myself its treatment here.

But I must not pass over the question of the necessity of medical treatment, the question: Do the scolioses require medical treatment and under what conditions and to what degree do they demand it?

The question is at first very easy to answer for the malignant form. Such severe diseases cry out for medical help. This must be offered as soon as possible and as effectively as possible. Even when the success of the treatment compared with the expenses of all kinds which we are compelled to incur does not appear to be satisfactory. Then even the slight success at first becomes a profit for the patient by enabling him to make use of his future.

It is quite different in the case of the mild scoliosis which at its worst is only a blemish, easily corrected by a clever tailoress. It comes to a standstill with the complete development of the body and in a great percentage of cases spontaneously heals completely. As we see, a quite different picture to that presented by the malignant form of scoliosis.

The medical duty as regards the mild form is fulfilled when we have diagnosed it as the mild form when we have confirmed our diagnosis by observation and when we take care that our patient does not do things which might transform the mild into a malignant scoliosis.

I cannot recognize a necessity for treatment in the case of the mild form. It is our sacred duty as honorable medical men to be quite clear about the fact that when we take the mild form into treatment that we are playing with work, and that we are making luxus cures. It is our sacred duty to inform our patient of this with all possible clearness and it is also quite as serious a duty to consider in every case whether the sacrifices which the cure requires correspond to the possible advantages to be derived from it. From a well-to-do family which under no circumstances will have a blemish on the child we may take the child with the slightest indication of a mild scoliosis into treatment, we may, if there is no other way, order a great, expensive cure. It is quite a different question, however, with a family of smaller means. We must never prescribe a cure in the case of mild scoliosis, which would cause any expenses worthy of the name.

These same considerations should hold good when it is a question of using public or charitable funds. In the care of cripples, at least in the field of my activities, is seen most clearly the necessity of providing possibilities for the treatment of the malignant scoliosis. Just as energetically as I demand that great funds should be placed at our disposal for this on the side of the state, public bodies, and public charities, just so emphatically do I agitate against the wasting of such moneys, the work of voluntary helpers and the time of assistants, in the treatment of mild scoliosis.

After answering the question, under what circumstances we are to treat it, comes the question: how we are to treat scoliosis.

In all therapeutics, *prophylaxis* is the first task, and this is also the case with scoliosis. Here also we cannot pass over the prophylaxis of scoliosis.

A condition for every prophylaxis is an exact knowledge of the etiology. We cannot prevent a disease if we do not know its cause.

In searching for the etiology of scoliosis we have arrived at the conclusion that the cause of the formation of scoliosis is a disturbance in the weight equilibrium of the spinal column. For the prophylaxis comes the conclusion that we have to prevent the occurrence of such disturbances, that is a conclusion very easy to make, very simple and also quite right.

It has only one thing wrong with it and that is it does not work out in practice. If we wish to prevent the disturbances of the weight equilibrium of the spinal column, we must first go into the question how can and do such disturbances arise.

In the researches in the etiology of scoliosis we must, therefore, go a step further.

The disturbance in the weight equilibrium of a weight-carrying column may be conditioned in two ways by a diminution of the carrying capacity of the column on or from the side of the burden, by an increase in its weight. Both possibilities can, of course, occur together.

If we seek for moments, at which the static loading of the spinal column can be increased and its carrying capacity diminished, we can place in the second group straightway those diseases a specific property it is to soften the bones. There is absolutely no doubt that a rhachitic as well as an osteomalacic spinal column possesses a diminished carrying capacity. Also in the case of the so-called constitutional scolioses the carrying capacity of the spinal column is reduced without doubt. I only remind you that these bones give pictures which are not to be distinguished from those of real rhachitis (Rupprecht, Schmorl and others). The science of late rhachitis rests principally on these pictures.

Further, the bearing capacity of the spinal column varies very considerably without its being up to the present possible to recognize this from the anatomical state. Even anatomically quite healthy spinal columns behave differently as regards their bearing capacity.

When the vertebral bones are introduced into a crushing machine such as is used by technical men for testing building and other materials as to their resistance to pressure one obtains very interesting results.

There are found on vertebræ, in which we cannot find any anatomical difference, extraordinary differences in the bearing power, the resistance to breaking, the ability to be compressed and the power of returning to the old form after the load has been taken off. After carrying out a considerable number of examinations and regarding the results, one sees that in the thousand variations there are, however, various distinct types. *E.g.*, for healthy vertebræ of different ages pressure curves may be drawn and it can be ascertained that vertebræ which deviate considerably from the normal pressure curve are in some way pathologically changed. Such disturbances are seen in rhachitic vertebræ. They may be seen in vertebræ which have been visited by a trauma, without any traces of the trauma being able to be anatomically proved. Further disturbances are seen in the cases of vertebræ which come from persons who have died of general wasting diseases, also in periods of particularly rapid growth and in the period of development during puberty such pictures appear to occur very frequently.

The disturbance in all these cases is of such a kind that that vertebra can be more easily deformed under the influence of pressure than under normal conditions.

The results of these investigations which I have had made and concerning which to furnish detailed information tally with the old results of practical observation: under all the circumstances under which we observe the development of severe scoliosis we find abnormal pressure curves in the crushing machine.

We find in this way the explanation why a scoliosis is formed on a spinal column which shows rickets or rhachitic diseases. One understands why, following trauma, a scoliosis can occur, how scoliosis appears after measles, scarlet fever, whooping-cough, how scoliotic curvatures appear in the time of particularly rapid growth or during puberty, how scoliosis can set in in the case of women after rapidly following pregnancies or how old scolioses can be made worse.

This will suffice for examples of the diminution of the carrying capacity.

How is it now with the increase of the load?

The conception of load consists of two components of the greatness of the weight imposed and of the duration of the burden. A light load which is imposed for a correspondingly longer time gives the same load effect as a heavier one which only is carried a correspondingly shorter time. An overloading may, therefore, occur by the imposition of too heavy weights, but may also be caused by a weight not too heavy if it must be carried an abnormally long time.

If we seek for examples of both, there is the classic example of the stone carrier's scoliosis. In Berlin it is usual to have the bricks carried up into the building by workmen. These workmen are extraordinarily strong men, with figures of athletes, whose vertebræ certainly possess normal carrying capacity. As a sickness peculiar to their profession there is found among these hod-carriers the scoliosis described by Golobiewski. There can be no doubt that it is caused by overloading.

Examples of the injurious effect of a load carried an abnormally long time are easier to find. I can quote the apprentice's scoliosis described by myself.

I often see among the working classes of our people young persons of both sexes from fifteen to twenty years of age who have contracted scoliosis after having left school and taken up some profession which entails long periods of standing or walking or much sitting. The scoliosis which one sees in these patients develops generally very quickly to a very high degree and they generally go about with severe symptoms of insufficiency.

The disproportion in the loading conditions is, in this case, caused by the spinal column which up to then had done its work, being called upon to carry the not abnormal weight of the body for a more than normal time.

In this connection I should like to add a few remarks on the importance of the school in the formation of scoliosis.

Formerly we looked for a very first cause of the scoliosis formation in the school. Hoffa would consider nothing else. If anyone uttered his doubts to him he did not consider a reply necessary.

I myself as a pupil of Hoffa have also lived with the idea that the school was an important etiological moment for the formation of scoliosis and believed to find the explanation in the fact that the long duration of the sitting in the school was accompanied by an abnormally long loading of the spinal column and that in this way the disproportion of the loading conditions and the scoliosis were brought about. Here I had made a serious miscalculation. The scholar sitting in his desk supports himself on his elbows and leans against the back of the desk. In this way he removes a part of the load from the spinal column. The injuriousness of the abnormal duration of the sedentary work may thus be completely balanced.

That we find among our youth an increase in scoliosis during the school years can be explained without the school necessarily being the cause. During the school time occurs the greater part of the bodily growth, in the school time occur the greater number of the children's sicknesses, during the school time almost without exception the puberty development takes place.

Those are important factors for the formation of scoliosis which completely explain the increase of scoliosis which occurs in this time.

Not only that, I am fully convinced that the school offers our youth a certain protection against scoliosis, simply because the children load their spinal columns during a great part of the day only comparatively little.

In order to prove this to you, gentlemen, I remind you of the investigations which Kirsch undertook in the case of the Magdeburg school children. Kirsch examined the children who came to school. Among them he found a small percentage (about 2 per cent.) scoliotic. These scolioses showed themselves to be the severe malignant forms. During the school time the number of scolioses rose to 20 per cent. and 30 per cent. On investigation, however, it appeared that the number of malignant scolioses had not increased. What had appeared during the school time in addition to the 2 per cent. which came to school, were light mild scolioses.

If you place my observations on apprentice's scoliosis, that is, the fact that young people who leave school free from scoliosis by no means seldom contract scoliosis and in quite a large number of cases very severely, together with these investigations, then, gentlemen, the opinion that the school does not represent a scoliosis forming peril but rather a protection against scoliosis will not appear to you to be so absurd.

Before I can go on, from these remarks about the etiology of the maldistribution of the loading which sets the formation of scoliosis in action, to come to any conclusions for the prophylaxis, I will go into a question which I previously put but have not yet answered. In the separation of the real and unreal scolioses I came to a halt before the static and before the paralytic scoliosis. I said that both in the static and in the paralytic we are acquainted with two stages: the nonfixed and the fixed. In the nonfixed we have the lateral curvature but no deformation of the bones, no formation of wedge-shaped vertebræ and no torsion. In the fixed stage we have changes in the bones characteristic of real scoliosis. How does our classification of scoliosis get over this difficulty?

Now, the explanation does not cause any difficulties. First we must ascertain that every static and every paralytic scoliosis may remain an indefinite time in the nonfixed stage. That the change to the fixed stage may take place at any time but is never a necessary result. Besides, these scolioses in a nonfixed stage are nothing more than quite unimportant symptoms of a disease. The importance of an independent clinical picture which we shall always allow to scoliosis is never allowed to these nonfixed static and paralytic scolioses. I only beg to remind you, gentlemen, that the nonfixed static scoliosis disappears at once as soon as the patient sits.

Again there is, however, no doubt that such static and paralytic scolioses can become fixed and that they then take on the characteristic forms of real scoliosis, indeed now and then they follow the path of the real malignant scoliosis.

The solution of this difference is as follows: If a spinal column is compelled, as a result of a difference in the length of the legs or through any other cause, to take up an oblique position for considerable lengths of time and to carry a burden while in this position, it comes by this means under less favorable static conditions than when such is not the case. Every column has a greater carrying power when it is perpendicular than when it is brought into an oblique position, and a load placed centrally on a pillar makes a slighter claim on the column than when it is placed upon it eccentrically. In the cases of the nonfixed and paralytic scoliosis we have in the first place a bringing of the spinal column into an oblique position and second, we have an eccentric loading as a result of the shifting of the center of gravity of the body. We obtain in these cases, therefore, first a reduction of the carrying power and second, an increase in the load to be borne.

It is now a question as to whether the spinal column possesses a reserve of power and whether this is large enough. If this reserve is great enough for the increased demands then a disturbance of the equilibrium of the load does not come about. These static and paralytic scolioses remain unfixed: they remain a symptom. If there is no reserve of strength at hand or if it is not sufficient, then a disturbance of the loading equilibrium arises and it goes on until we have the formation of a real scoliosis: the static, the paralytic becomes fixed. The scoliosis thus induced will naturally follow the path previously sketched out by the static or the paralytic scoliosis for it. It will imitate their form and will reach the degree conditioned by the degree of the abnormal loading conditions.

Now, gentlemen, let us come down to practice again and that with the question: how can we prevent scoliosis?

What may be generalized from our remarks for the prophylaxis of scoliosis?

We have come to the opinion that the malignant forms of the youthful scoliosis have their cause in a process of bone softening through rickets or rhachitic diseases, and that (apprentice's scoliosis) professional overwork may also produce severe scoliosis in the case of young persons. We have further come to the opinion that the mild forms in their causes are connected with rapid growth, with exhausting children's diseases and with puberty. These two lists would naturally have to be lengthened, but I make no claim to completeness.

If we look over this list to see what dangers we can remove from the way of our youth, we shall hardly be very pleased.

Rickets may be combated and one of the most important tasks of the care of the cripples will be the struggle against rickets. It will, of course, have a prophylactic effect in connection with the rhachitic scoliosis. In this way we should, according to my opinion, not greatly reduce the quantity of malignant scolioses. Even if the pathological anatomists show us ever so beautifully in microscopic preparations that the alterations by which he diagnoses the microscopic diagram of rickets, the alterations in the vertebræ of the so-called constitutional scoliosis, are to be recognized to the very smallest detail, still the forms and the course of the real rhachitic scoliosis differ so clearly from those of the constitutional that I cannot convince myself of the identity of the diseases of the bones which are certainly present in both cases. I am convinced there is here a weak point in pathological diagnostics.

The disease which, in the case of the constitutional scoliosis, diminishes the carrying power of the spinal column, we do not yet know.

We are therefore to-day not yet in a position to take any preventive measures against this the most important form of scoliosis.

We are in a more favorable position with regard to the apprentice's scoliosis. Here it would be sufficient if the school doctors examined the children before they left school and warned such as were not strong from taking up professions which demanded great bodily efforts. Besides this the medical profession must be made aware of the danger of scoliosis with youthful workers so that those falling ill with it may be withdrawn from their dangerous work in time.

When we come to regard the prophylaxis of the mild scoliosis we shall there also have to be satisfied with the prospect of half successes.

When a child shoots up particularly fast, when he falls ill with wasting diseases, and when he suffers particularly from puberty what can we do against that? We shall have to be contented with bringing those entrusted to our care through this period as well as possible. We shall guard them against overstrains, above all from overstraining the carrying capacity of the spinal column as much as we can. We shall endeavor to raise the level of their general state of health and to keep it at a high standard. We shall pay particular attention to the strengthening of their bone system, for example, by proper feeding, we shall try to strengthen the spinal column and its muscular system by means of sport, massage, and the like. But in all this there is no certain prophylactic present.

Still less is this the case with all the other things which hitherto have been recommended for this purpose. I will mention a few of them.

The school bench has been the cause of the greatest amount of writing as scoliosis-prophylactic. Certainly we should make the sitting in school for our children as easy as possible in view of scoliosis and in the choice of a school bench this should be the first consideration. But that, by the introduction of this or that bench, we could make a school free of scoliosis is a thing which we cannot for the world imagine.

It is just the same with the upright writing, which was once recommended as a preventive against scoliosis and has been widely introduced. It is the same with gymnastics in general and with the various systems of gymnastics in particular, the same with the reform of the girls' clothing and the same with the prohibition of corsets for the girl scholars.

All these things are very fine and good but they will not abolish scoliosis from our youth at school simply because they do not go to the cause of the formation of scoliosis.

When I say this here I do not do so from theoretical considerations, not because of an opinion which I have formed for myself; I simply repeat an experimental fact. Go, gentlemen, into those schools where those preventive measures have been introduced against scoliosis and you will find there quite as much scoliosis as in those schools which have done nothing against it.

Why do I quote this here, gentlemen? So that we, in future, shall not make such propositions! The unavoidable non-success discredits us.

The hope that we can stop up the source from which the scoliosis comes, and that it will only be a question of time when humanity will die free from scoliosis, we must for the present give up as unattainable and we shall have to continue to combat scoliosis, gentlemen, although the struggle has not yet shown successes which could stimulate us to further efforts.

A rational system of therapeutics can only be built up by ascertaining the demands which therapeutics have to fulfil, from the pathology; or in other words, we only come to a rational therapeutic system by deriving the indications from the pathology, and without any consideration whether these indications can be fulfilled or not. If these indications are obtained then we must keep beside them the therapeutic means available. We shall see from the summary what therapeutic means can come into question at all and we shall be able to estimate and try to what extent the indications set can be fulfilled by means of the therapeutic aids at our disposal.

If it is not possible to satisfy them, we obtain in this way at least a definite boundary to our therapeutic abilities and we shall be led to the point from where we can attempt to increase the scope of our therapeutics.

This is also to be the plan of my further remarks.

First: How do we obtain the indications for the treatment of scoliosis from pathology and what are these?

I have endeavored to prove that all real scolioses come from the same uniform cause: form a disturbance of the distribution of the static load on the spinal column. Further I have endeavored to prove that all real scolioses are characterized by definite anatomical changes of the spinal column or the torso-skeleton. Consequently, we should have to distinguish in the pathology of scoliosis, between the disease process of the formation of scoliosis and the result of this process: the scoliotic deformity. These are two pathological concepts which we have to keep perfectly clear from one another, not only when setting up the indications, but which we must also keep in mind in the case of every single measure which we take when treating a case of scoliosis.

The deforming process sets us the task of restoring the disturbed loading equilibrium of the spinal column; the deformity caused by the deforming process sets us the task of restoring again the normal skeletal form.

These are two tasks which lie in quite different directions.

We can expect from the outset that a remedy suitable for the solving of the one will not always by any means be suitable for solving the other. Indeed, it should not be at all surprising to us to find that a remedy which does good work in solving the one, has a direct negative effect in the case of the other. And then we have the further complication that both these so vitally differing tasks are set us at the same time in nearly every case of scoliosis which comes to us for treatment. In scoliosis the deforming process does not end at the moment when it has produced the deformity, but the deformity goes on increasing. It is almost never that we obtain a case where we can say, "Here the deforming process has come to an absolute standstill and the danger that it will become active again or that it will be started again by some treatment which aims at the correction of the deformity, is abolished."

In addition, the two indications are to be met with on the single object in the most varied combinations imaginable.

If we have a very early scoliosis, there is practically no deformity present. The indications of the deforming process prevail absolutely. If we succeed in healing it the trace of deformity which it produced is no longer of any importance.

With an advanced deformity it is different, where not only is a deformity immediately visible but also where the breast and abdominal organs are so severely dislocated and compressed that serious disturbances to the health result.

In these cases the indication to correct the deformity occurs with quite a different emphasis. When we succeed in bringing the deforming process to a standstill, we cannot yet by a long way speak of a satisfactory result. The deformity which still remains retains its injurious effects upon the figure, the vital forces and the life happiness of the patient. For this reason it requires correction.

Between these two extremes all possible combinations come into our hands daily.

Correctly to recognize the combination of indications of coming and complete deformity, in the single case, and to induce the correct method of treatment from them is one of the most important and most responsible but also at the same time one of the most interesting tasks of the whole scoliosis therapeutics.

When this situation becomes clear to anyone, he must straightway come to the conclusion that there never can be a uniform scheme for the treatment of scoliosis but that it demands a very sharp individualization.

If we regard the two indications singly, the deforming process, as already mentioned, when it is produced by a disturbance of the loading equilibrium, requires a restoration of the loading equilibrium.

This is quite a similar demand to that which the prophylactics of scoliosis placed upon us.

There we had to prevent the occurrence of the disturbance, here we have to remove the disturbance of the loading equilibrium.

The means which would have to be used in the two cases would be approximately the same. Here as well as there we should look for the cause of the disturbance and see how we could put it out of action.

Let us take the example again which we placed in the forefront when discussing prophylaxis, namely, rhachitic scoliosis, and we may expect that the spinal column will regain its normal carrying power on the curing of the rickets and that from this moment the loading equilibrium will be regained and the scoliosis will be brought to a standstill.

As a matter of fact the real rhachitic scolioses offer a very favorable prognosis in this respect. If we cure the rickets, then the scoliosis also comes to a standstill. And if we have known how to make the best use of the time from the beginning of the treatment up to this moment, the time in which there exists an increased plasticity of the spinal column and of the torso-skeleton, for the corrective measures, we can not only bring the rhachitic scoliosis to a standstill but also obtain excellent corrective results.

The real rhachitic scolioses, when taken in hand in time, are probably the easiest to influence therapeutically.

In this respect there is a great difference between them and the constitutional scolioses. Even when these, as I have already remarked, look exactly the same in the microscopic bone preparations as the rhachitic; yet the antirhachitic general treatment which attains such a complete success with those breaks down here completely. We do not possess a specific means in these cases of restoring the diminished carrying power of the spinal column to its normal condition.

When we come to the mild scolioses, where we must suppose slight disturbances of the carrying power of the spinal column, we have also there no specific means of healing. In the case of a softness due to rapid growth, weakening of the resistance of the bones by a wasting general disease, or by puberty, we can only improve the carrying power of the vertebræ by a raising of the general health all round, by an improvement of the constitution. Indirect and slow to reach its goal as this method may be, yet it is important to adopt it in the case of the mild scolioses. In this point correct prescriptions are altogether the most important in the treatment of these cases. Very often we can and must limit ourselves to such prescriptions. And besides this, the other therapeutical measures will only attain their possible success when the right thing has been prescribed and carried out here.

What it is necessary to prescribe for such a constitutional improvement I will not go into. It is there a question of things which are not specific to the scoliosis therapeutics but of measures which are the general property of therapeutics.

The investigation of the means of treatment coming into question for the deforming processes here shows a deficit. We cannot balance every factor which occurs as disturber of the loading equilibrium by a counterpoise, or, to use the ordinary medical terms there are quite a number of disturbances of the youthful body which reduce the carrying capacity of the spinal column without our being able to oppose a specific remedy to each such disturbance.

That is a regrettable fact but all the same we are not at the end of our therapeutic remedies. Where there are no specific remedies we can often help the patient very much with symptomatic or palliative treatment. Here also. If we cannot restore the disturbed loading equilibrium by destroying the cause of the disturbance, we can attempt to attain the same end by the insertion of some means which robs this disturbing cause of its disturbing effect.

Let us take for example a pair of scales in which the beam is brought into an oblique position by a weight placed upon one of the scale pans, the horizontal position may be restored by taking away the weight—that is etiological therapeutics, or one may restore the horizontal position by placing an equal weight upon the second scale pan—that would be the equivalent of symptomatic or palliative therapeutics.

It should not be objected that palliative remedies finally lose their effect, because, in any case they can only be used for a limited time. In the case of the scoliosis-forming process we have always to do with long periods of time, as I have emphasized; in the most severe forms really with the whole life. That is indeed quite right. We perform, however, good service even if we only retard the deforming process with palliative remedies and there are even cases where a severe constitutional scoliosis has come to a standstill under palliative treatment.

If we make practical conclusions from these considerations, in every case where we have the task of treating a scoliosis-forming process, that is in the case of every beginning or advancing scoliosis, the first thing to do is to take measures which can remove the primary cause of the deforming process and then other remedies are to be drawn upon which, without regarding the cause of the disturbance of the loading equilibrium of the spinal column, are capable of restoring this equilibrium.

What are now the remedies which might come into question? There are two classes of them: first those which are able to increase the carrying power of the spinal column, second, those which are capable of reducing the load.

In the first place as means of strengthening the spinal column may be mentioned our physical curative methods. In the very beginning massage, electricity, hydrotherapeutic measures, thermal excitations and the like and then the curative gymnastics.

With massage and like treatment we do not indeed influence directly the spinal column but we can influence the circulation near it and so obtain advantages for our purpose by, in this way, exciting the nourishing processes in the vertebræ.

That is the basis upon which the use of massage in the treatment of scoliosis rests. Its aim and its effective possibilities lie in the strengthening and in the increasing of the carrying power of the spinal column. Its regular and effective use in the form of back massage is indicated in every case where it is a question of a scoliosis which is in a stage of development or becoming worse.

How the massage is to be carried out so as to obtain the best results, how and in what form the above-mentioned physical curative means other than massage are to be employed I will not go into here. They are things of minor importance.

We must, however, devote a more thorough consideration to *curative gymnastics*.

Gymnastics have played an exceedingly important part in the treatment of scoliosis for a long time and in all parts. There have been and there still are doctors who consider gymnastics as the foremost remedy in the whole range of scoliosis therapy, and there were and still are such as see in it the only really employable and successful remedy. At the same time we find when we look through the works on scoliosis gymnastics that there is very little about the theory of its influence and what we find is particularly contradictory and will generally not stand a sharp criticism.

Here also it is a crying necessity to establish a firm foundation. I think that this may be obtained by examining what curative gymnastics can do to satisfy the indications set up by us. From this it will be possible to induce the field of employment of scoliosis gymnastics. We shall obtain certain and sure opinions about its usefulness and a judgment concerning the value of the varying gymnastic methods.

The vital principle of scoliosis gymnastics consists in the carrying out by the patient regularly over a prolonged period of certain motions by which the muscles surrounding the spinal column come into action and the single parts of the spinal column are moved against one another. Generally the exercises are so carried out that the bent parts of the spinal column are brought into positions opposed to the curvatures. The intention which is generally followed in these active corrective exercises is to give the deformity an influence for good. Therefore corrective intentions generally are the aim followed by scoliosis gymnastics. Whether and to what extent these aims are attainable we will investigate in the discussion of the means of correction. Here in the first place we will occupy ourselves with the question: how and whether gymnastics is a means of bringing the deforming process to a standstill. To do this the gymnastics would have to be able to reduce the load upon the spinal column or increase the carrying power of the spinal column.

It is hardly probable that anyone will assert that we reduce the load on the spinal column by means of gymnastics. Even when we prescribe exercises with apparatus which diminish the load on the spinal column during the exercise or when anyone prescribes the so-called crawling exercise, we cannot seriously make such an assertion. The time during which this diminution occurs is as nothing compared with the time in which the load exercises its full weight.

The specific quality of gymnastics, which we here have to reckon with, consists in the fact that gymnastics compel the spinal column and its appendages to do some work. That is a factor with which we really can reckon.

We know that the bones and muscles of a man who works energetically with his body are stronger than in the case of one who exercises his body to a less extent. We know further that the bones and muscles can be strengthened by exercise. Therefore we may come to the conclusion from this that a backbone which is too weak for the task imposed on it may be strengthened by work in the nature of exercise and we obtain a prospect of equalizing a disturbance of the loading equilibrium on the spinal column by means of curative gymnastics.

In this way we should have the same indications for the gymnastics as for the massage.

This conclusion, gentlemen, is quickly come to. It corresponds to the general estimation of gymnastics as a means of treating scoliosis and, when I say it here, could hardly be contradicted. And yet I should like to place it under the lens of a sharp criticism again.

Scoliosis arises when the spinal column is not able to perform some definite, in itself, physiological work. It is a sort of fatigue disease. But otherwise we do not treat fatigue diseases with excitations of energy. An eye which has been overstrained is not treated by any doctor with reading exercises. On the contrary the first order which the oculist gives is to forbid or, at least, place a limit on reading. We, however, gentlemen, treat the spinal column, which suffers a curvature as a result of overstrain by giving it work to do which, up to the time, is unknown to it and in which it has had no practice! This comparison is, like all other comparisons, naturally a little lame; even if an excitation to work is injurious to the overstrained eye, it is not by any means proved that it may not be employed with beneficial results in the case of the spinal column, under circumstances which possess a certain similarity. This comparison, gentlemen, should show us, however, the necessity of a serious examination of this question.

How shall we set about this examination?

Theoretical considerations cannot have the last word here. We must here rely on the experiments of practice.

As already mentioned, gentlemen, gymnastics are everywhere regarded as an excellent means of treating scoliosis. An especially good point about it is the fact that it can at least do no harm, it is said. As positive results of gymnastics are quoted, the facts that mild scolioses are cured, medium ones improved and in severe deformities a retardation of the deforming process is said to have been attained.

A favorable influence on the deforming process is thus asserted and in institutions which can boast of particularly exact work, measurement diagrams and photographs are shown as proofs of the correctness of this assertion and which in point of fact appear to confirm those results of scoliosis gymnastics.

I say emphatically appear, for in fact these photographs and measurement diagrams prove nothing!

The spinal column is a movable thing and it can carry out movements which to a very great extent can cloak scoliotic deformities. How difficult it is sometimes, gentlemen, to form a good view of the scoliosis on the patient undressed before us. How often must we make use of special tricks before the child forsakes the stiff position which it has taken up for the examination and lets us see the back in an indifferent position. How often are we astonished to find that then a totally different picture appears to that which we had seen on the first glance!

Further consider the following: As soon as a child comes into treatment for scoliosis and particularly when a gymnastic cure is begun, the child hears at every step, "Keep your back straight." All gymnastics carry out corrective exercises, that is exercises which are specially qualified to cover up the deformity. Well-drilled scoliosis patients are perfect contortionists. They learn to control the movements of their spinal column in a most astonishing way and at the same time they learn to cloak even considerable deformities. In this way, of course, the deformities do not disappear. But as soon as the child comes near the doctor, or under the eyes of its parents, or as soon as it itself thinks of scoliosis it stiffens up the muscles of its back and sets its spinal column in apparent correction.

Here is the source of the most disastrous disappointment.

Everyone who works with such scoliosis measurement diagrams will tell me that they must, of course, never be taken in such correction positions, but that the patient must be induced to take up a medium indifferent position. Quite right, but how shall the indifferent medium position be found? The child indeed by movements of its muscles can also even stop an apparent progression of its scoliosis. Who can tell me where between the two extremes of greatest possible apparent correction and the greatest possible apparent fault, there is to be found the indifferent mean position? Nobody.

If we want to work with measurement diagrams or with photographs, as a proof of the results of scoliosis correction then we must totally reject all diagrams which do not show changes which do not go beyond the possible degree of apparent correction. Only then do these pictures have any power of proof, when they show differences which could not have been attained by active movements of the spinal column. If one specializes these rules which hold good for the whole therapeutics of scoliosis, for the gymnastic treatment, one has to say, that up to the present, diagrams or photographs which show successes obtained by gymnastic cures have not been shown.

All the results of scoliosis cures which we have noted above lie in the region of the possibility of apparent correction.

It might go, gentlemen, still more against your grain, when I put the further question: can perhaps gymnastics have an injurious effect in the treatment of scoliosis?

No one will deny that, in spite of gymnastics, scolioses may suffer severe aggravations. When this takes place the general explanation given is, that not enough gymnastics have been done or that the process was too bad for anything more to be done than to produce a retardation. Of course it is always asserted that a retardation has been attained.

The first to assert that scolioses were aggravated at least sometimes, not in spite of gymnastics but through gymnastics, was Chlumsky. Beside him I have also appeared with the assertion that gymnastics could have an injurious effect in the treatment of scoliosis. Up to the present we two are probably alone.

The question, however, is so important and I am so convinced that we two, in spite of our isolation, are right that I must, here, lay our point of view clear.

Anyone who treats a fairly large number of scoliosis patients by means of gymnastics will have a source of satisfaction with a certain proportion of them. The children show visible improvement, they take on fresh colors. Their bodies become firmer and the impression is forced upon the most doubting doctor that the scoliosis is coming to a standstill, is undergoing an improvement. In such a case gymnastics cannot have done any harm.

Alongside these children there is also a number who are not a source of satisfaction. They begin their cure alright. But it does not last long before they miss, at first one, then several days from the hours of treatment and finally they remain away altogether generally without any explanation being given.

I recommend you, gentlemen, to follow up these cases which you as well as I have experienced. You will then hear the following from the parents and the family doctor: The child has not been strengthened by the gymnastic lessons but has plainly suffered from them! Even before it was not in exactly perfect health, that is why the gymnastic lessons were begun but the hoped for strengthening did not appear. Rather the whole being of the child became characterized by an increasing slackness. Loss of appetite, disinclination to work, chlorotic complaints were more clearly to be seen every day, and the improvement of the carriage of the body which was specially counted on did not appear. After stopping the gymnastic lessons the child slowly attained the same degree of health as before the gymnastics.

When you, gentlemen, examine such children about whom you hear such things, and if you are in a position to form an objective opinion about your own work, then you will only be able to confirm what the parents and the family doctor have said. And if you examine the backs of these children you will find that the scoliosis has never improved, but on the contrary generally become aggravated to a most pronounced degree. You will also concur when the parents and the family doctor blame your gymnastic cure for the breakdown of the patient and the aggravation of the scoliosis, if you have convinced yourself by going over a fairly large material that it is not here a question of a single case, but that of a regularly repeating, typical occurrence.

Therefore, gentlemen, do not shrug your shoulders over the cases which remain away from the gymnastic lessons but follow these patients up carefully. You will then come to the same opinion as I, that although gymnastics can perform very good service in cases of scoliosis, yet they can break down and that even injurious effects may arise.

With this conviction one arrives at a difficult position. What is to be done now? Shall we reject a remedy which performs such good service in so many cases? No, we must only stop treating every scoliosis with gymnastics and we must learn to distinguish those cases where gymnastics form a remedy to be employed, from those where we cannot reckon on a reasonable success.

Is this distinction possible? Yes, the excitation may also be employed even in the case of fatigue diseases, only one must not forget the rest; the condition of weariness must not be too great and the whole organism must have a great reserve of reactionary power! That also in the case of scoliosis!

A gymnastic cure must not be simply written down on the programme of the daily life, but we must place a few considerable limitations upon it. Especially suitable for gymnastic treatment are relatively originally strong children and finally such cases where the loading equilibrium has not been too greatly disturbed.

On the whole, gentlemen, you will agree with me but you will also ask me, "How shall we ascertain whether this equilibrium has been greatly or not greatly disturbed? From the degree of the deformity it is not possible to estimate it, then, *e.g.*, in the case of a malignant scoliosis the loading equilibrium is seriously disturbed in the very first beginning but there is only a very slight deformity present. In the case of a severe deformity which has come to a standstill, the equilibrium on the other hand has been restored.

Here, gentlemen, I should like to draw your attention to something which I have described in various works and which I have also touched upon in my article to-day—the insufficientia vertebræ.

By the presence or absence of this symptom-complex it is possible to judge whether, with very few exceptions, at any time there exists a misrelation in the loading of the spinal column and it is possible according to its greatness, to estimate the amount of the disturbance of the equilibrium. Thus the insufficientia vertebræ is not only an excellent aid in the setting up of the prognosis but it also gives us an important criterion when the question is whether gymnastics would be beneficial or not.

Allow me, gentlemen, to sketch in a few words more how the insufficientia are seen in the case of scoliosis and how we can utilize the condition of things for our therapeutics.

When scoliotic patients come into our consulting room, they seldom complain about anything else than the deformity. Only elderly patients complain about pains in the back, sides, and in the front of the body. We are also not used to inquiring about subjective complaints in the case of scoliosis. If we do so we obtain more often than we expect the statement that there are troublesome pains in the back or at least, that feelings of fatigue are experienced. If we tap along the spinous processes, we come in very many cases one might say regularly, to painful spots. These are generally to be found on the vertices of the curves. Sometimes their region is larger, sometimes smaller. Also pressure on the lumbar vertebræ from the abdomen is almost always painful in the case of scoliotics.

This is the usual state of things in the case of youthful scolioses.

In the case of real rhachitic scolioses with very small children it is generally not possible to prove the painful spots. The sensibility to tapping in the line of the spinous processes is missing also often with scolioses which occur with a flat back.

If one examines a large number of cases for these painful spots and observes the cases over a fairly prolonged period the following may be clearly noticed.

These painful spots are there when a scoliosis is forming or being aggravated, that is when, according to our etiology of scoliosis, there is a disturbance of the loading equilibrium. The pains are so much greater according to the speed at which the process of aggravation goes on, the more unfavorable the whole prognosis is, that is, the greater the disturbance of the loading conditions is. The pains diminish, they disappear altogether, when the scoliosis comes to a standstill, that is when the loading misconditions are counterpoised.

From such observations may the means sought for, be found, which will give us the key as to what we have to expect from a gymnastics cure.

Cases in which there are no symptoms of insufficiency present, and where the general constitution lets us suppose a good reserve of reactionary power, may be treated with gymnastic treatment without any worry. Good results will be obtained. Cases, however, which show severe symptoms of insufficiency are at first to be kept completely away from gymnastics. First in other ways the equilibrium is to be, at least approximately, restored, and then one may try how gymnastics can be *tolerated.* One must be very cautious and check the painful spots more carefully during the treatment. As soon as the pains increase, diminish the gymnastics or stop them altogether. In cases where the symptoms of insufficiency are of medium degree one commences just as above.

If one does not do so, if one takes these patients with pronounced insufficiency energetically in hand because the cure does not go on properly then one will experience the relapse, the breakdown of the patients as I have previously described. And the final result for the scoliosis will not be an improvement or a cure but an aggravation, and this aggravation, gentlemen, will not arise in spite of, but because of the gymnastics.

The means with the help of which we can restore the disturbed loading equilibrium on the spinal column are still not yet exhausted. There are still those by the help of which we can reduce the load falling on the spinal column.

I mention first lying on the back.

When we lay a patient flat on his back, the spinal column is free from all carrying work.

Ordering a patient to lie on his back dates from the earliest times in the curing of scoliosis. And we can here only recognize it as very suitable to its purpose. It is particularly suitable in the case of small children with rhachitic scoliosis. In the case of older children I lay great importance on their lying on their backs at least one hour daily at best immediately after the midday meal in bed.

A second means which we possess of reducing the burden on the spinal column are the supporting apparati the effect of which is to remove a part of the burden from the spinal column and take it themselves.

These supporting apparati form one of the earliest aids in scoliosis therapeutics a thousand times recommended and as often useless, indeed combated as injurious.

Are they useless? Are they injurious? When are they useful? When are they injurious? Which apparati are employable and which not? With what precautions may they be used? Those are quite a number of questions which we must answer here.

According to our opinions concerning the origin of scoliosis supporting apparati have a place in the combating of the deforming process.

The simple rod apparatus, the orthopedic corset, this latter in conjunction eventually with a head rest, they are all capable of taking over load from the spinal column; the rod apparatus to a less degree and only from the lower parts, the corset removes more and its influence reaches further up. If we supply it further with a head rest, the spinal column may be relieved over the whole of its length.

The fact that these machines really attain the desired aim or at least make progress in this direction may again easily be checked by means of the insufficiency symptoms. When you, gentlemen, bring scoliosis with the painful places as described under the influence of such apparati you will obtain in the shortest of time a reduction in the pains to complete disappearance and if you apply these machines in the case of a scoliosis which has become visibly worse you will recognize, with a little observation, that a standstill occurs in the aggravation. In a certain number of cases this standstill continues, in others it is only a pause. In these cases after a more or less short time the scoliosis again makes progress. These advances may even take place at a rate not reached before and the scoliosis may, although more perfect relieving apparati are used one after another, reach finally the highest degree. Whether in spite of, or on account of the apparati may be asked just as in the case of the gymnastics.

How can we arrive at an answer to this question?

The cases which are brought to a permanent standstill by means of the relieving apparati, belong almost exclusively to the group of mild scolioses. The others belong principally to the malignant. The explanation of the double behavior is as follows:

When we place any part of our body under the influence of a relieving apparatus, we obtain always, as undesired by effect, an inactivity atrophy. I remind you of the atrophy which we obtain when using the relieving apparatus for the legs, even when the disease has no atrophying properties. That is naturally also the case between the spinal column and its relieving apparati. The subject of observation does not allow the atrophying bye effect to be seen so soon and so clearly, but it is doubtless present.

Whether we obtain a favorable or an injurious effect from our relieving apparati, depends completely on what part the atrophying factor plays in our equilibrium example.

If we have a slight disturbance with a disposition to correction, the body will make the best use of the relieving influence in order to again arrive at equilibrium. The great thing is then to remove the supporting apparatus when it has done its duty and not to allow any atrophying effect at all to develop.

If, however, we have a severe disturbance, then, by means of the influence of the relief, the scale inclines to a position of equilibrium. If, however, the inactivity makes itself felt, then this again falls into the scale as a new disturbing factor and the minus thus caused can quite easily come to equal the plus attained by our relieving apparatus, it can indeed exceed it. We then obtain a disturbance of the equilibrium equal to or greater than the previous one and our scoliosis from this moment will be aggravated again at the same rate or even quicker than before the application of the relieving apparatus. We then obtain after a shorter or longer interval, a new aggravation of the scoliosis in spite of, indeed, on account of the apparatus.

What have we to learn, gentlemen, from these observations? I think the following:

The scoliosis relief apparatus is, like gymnastics, not a harmless remedy. Where we use it the danger of an aggravation threatens us through its bye effect of inactivity atrophy. The scoliosis relief apparatus is, therefore, only to be used in connection with remedies which work against the inactivity atrophy. And its employability only goes so far as we succeed in combating this inactivity atrophy. At the very least the inactivity atrophy should not become so strong that it exceeds the positive performance of our apparatus.

Placed in the form of a medical ordinance it runs: Besides the relief apparatus, massage and other means which serve a strengthening purpose are always to be used.

We should thus come to the end of the examination of the means which come into question with regard to the treatment of the scoliosis forming process.

Let us now turn to the means of fulfilling the second indication of the scoliosis therapeutics, to those which might serve for the correction of the deformity, and subject these to the same examination.

Here I should like first to mention a few remedies which used to play a great part, but which are, to-day, seldom heard of. I mean principally the so-called functional adjustment. There was a time when the functional adjustment appeared to be the deus ex machina, when the orthopedic science was at its wits' ends. Old beliefs have had to make way for the exact researches even in orthopedics. There is nothing said in modern works about functional adjustment. I will not bring out that old ghost here again, I will not make any attempt to kill it completely. Belief in such things only dies slowly; but still quickest when it is ignored.

I will also not argue with the premise; that one should correct scoliosis by raising the tone of the muscles of the spinal column on the convex side of the scoliotic curvature. The back muscles run over the convexities and concavities in every scoliosis. That it may be possible to raise the tone of a certain portion of the long muscles without also producing a raising of the tone of that part of the muscles which runs over into the convexity, that is, a little trick that I do not think at present possible. And even if it succeeded, it is too childish an idea to think that sufficient strength would become free to bend back a scoliotic spinal column into its place. Only look at the alterations in the bones of a scoliotic skeleton, gentlemen. There can be no mistake that a far greater strength than that supplied by tone differences is needed for the re-forming of such large and so seriously deformed bone masses.

If we come to means of correction whose working we can really imagine, we must, in the first place, devote a few words to the strength of the body for self-correction. The body is capable of a considerable self-correction with regard to static loading deformities. I draw attention to the rhachitic leg curvatures.

That the body can also remove scoliotic deformities by means of self-correction is not to be doubted which I have already often pointed out. The mild scolioses often disappear with the complete development of the body without any treatment having taken place. Those are doubtless self-corrections. Certainly the re-forming processes which have taken place there are not very great. I have not yet seen a really severe scoliosis disappear in such a way neither have I seen any considerable improvement. I do not regard the reports which now and then crop up in the literature without a certain measure of doubt.

We do not know in which way the living body brings about the correction of the milder scolioses. I presume that the longitudinal growth plays some part in it.

Scoliosis gymnastics are also still esteemed as a corrective means. When examining their utility with regard to the treatment of the deforming process, we several times touched upon their utility as a corrective means. Here we must go into this question more thoroughly.

The plan which forms the basis of correction cures when gymnastics are employed, is the making flexible of the spinal column by means of exercises; the flexibility shall allow the straightening out of the deformity and the muscles, strengthened by the exercises, are to keep the spinal column in the correction form obtained by the bending back, until a re-forming of the bones has taken place. Generally it is pointed out that scoliosis is primarily a contraction of the joints and that these plans of treatment are formed after the type of treatment of such contractions.

The primary mistake lies in regarding scoliosis as a contraction of the joints. Just as little as a juvenile genu valgum, or a rachitic genu varum is a contraction of the joints, just so little is scoliosis. Just as little as one can correct a genu varum, or a genu valgum by movements of the knee, *just in so much is it unsuccessful in the* case of scoliosis, that is, we do nothing more than bring about a temporary cloaking of the deformity, an apparent correction, but neither now nor at any time a real correction.

According to my firm conviction gymnastics as a means of correction are absolutely useless.

Where the results of treatment appear to prove anything else it is either a question of the self-deception of the medical men concerned, or else the always slight results have been brought about by other means than gymnastics, especially by means of the body's power of correction.

Let us continue, gentlemen. The knife and the chisel which are otherwise our best servants in the correction of bony deformities, cannot be made use of in the struggle against scoliosis. The few attempts which were made in the form of the resection of the deformed ribs, will, I hope, never be made again. I have assisted my teacher, Hoffa, at such an experiment. The impression which we had at the time was expressed by Hoffa in the words "Only once and never again."

Among our outfit for the correction of deformity there still remains mechanical pressure and strain. What these means are able to perform when used in the right place and in the right way I will show by the dressing of a club-foot and will point out the successes to be obtained thus.

Let us see in what form we can apply pressure and strain to a scoliotic spinal column and what results we thus obtain.

I must here name two forms of the use of mechanical pressure and strain which are usually but falsely regarded as massage and gymnastics; these are manual rectification and rectification with the help of the stationary rectifying apparatus of our gymnasiums.

We usually exercise the manual rectification in connection with massage or in the intervals between the gymnastic exercises and they usually consist in applying a considerable pressure with the hands with the idea of bending the deformity back. In the use of the rectifying apparatus the same effect is obtained by the apparatus. The difference is that we can let the apparatus work longer than the hands.

The momentary effect of these rectifications is very striking. Rib deformities of considerable size can be totally pressed out of existence, the curvatures can be corrected, indeed, pressed to overcorrection, but the deformity returns with the removal of the pressure and the most careful observation cannot ascertain a gain in the shape of correction. In spite of that, I believe that manual rectification and the stationary rectification apparatus can show corrective results. Gutta lavat lapidem! But great perseverance and patience are necessary, endless repetitions, and the correction obtained is and remains only very slight.

From the stationary apparatus of our gymnasiums to the lying apparati which are principally used by the patients during the night rest is only a very short step and they also exercise a corrective pressure and strain.

These apparati played first fiddle in the treatment of scoliosis by the old orthopedics. Then they went quite out of use as the Swedish drill obtained its, unfortunately false, reputation; quite out of use as the best, indeed, the only remedy for scoliosis. They have again won a place in our therapeutics after Lorenz has given us an up-to-date form in the plaster-of-Paris bed, for the so-called scoliosis extension beds.

The plaster-of-Paris bed may be prepared in such a manner that the patient when lying in it, comes into a position of correction and pressure influences in the sense of correction are brought into action.

I prepare my plaster-of-Paris bed as follows:

The patient is laid upon a bed invented by Nebel in which he lies obliquely in suspension. The back is covered with stockinet. By means of bindings which pass from the trunk to the side rods of the apparatus a correction or overcorrection is brought about. If there is a pronounced hump on the back then I place opposite it on the flattened part of the back a bolster of felt and wadding. Now the back and sides of the patient are covered with plaster bindings and with loose materials dipped in plaster so that a sort of jacket is formed which reaches up to the edge of the hair, which is continued upward on both sides above the height of the shoulders and holds them with a piece, the lower edge of which runs as far as the gluteal folds and the sides of which run approximately as far as the anterior axillary line. After the jacket has hardened it is taken off and dried. During this process the side walls must be prevented from bending up. Then follows the trimming of the plaster bed-jacket. The first thing to do is to remove the bolster which has perhaps been placed on the back and in this way a sort of niche formed opposite the hump. In addition there are fixed on the back surface two iron rods, bent so__|‾‾‾|__ and which raise the bed, placed on a horizontal surface, about the width of three fingers. The idea of the cross-pieces is to prevent the patient lying in the plaster jacket from rolling over on to the side with it. In addition sharply projecting felt cushions are glued into the plaster jacket and which press on the highest part of the lateral curvature.

I place my patients in this jacket over night and sometimes for an hour or two during the day. If I have the patient in my institution or if it is a case of a particularly serious deformity I have it extended to the head.

Now, gentlemen, the results of these plaster jackets! I have a relatively high regard for them. The correction effect is generally to be remarked in a relatively short time. Specially clearly are the flattening out of the curvatures to be seen when the top of the curvature has not been quite correctly judged. One then sees a flattening out of the rib deformity alongside the height of the curvature.

At the same time the patients very soon get used to the plaster jacket, it is easy to make, its cost is not too great and it may be used quite a long time (one-half to one year) before it must be renewed.

In the old orthopedics portable rectifying apparati in addition to the extension beds, commanded the scoliosis therapeutics.

What interest and what work our forefathers devoted to the construction of these apparati is almost incredible. When I was preparing my handbook on orthopedic technic the viewing of the material was no easy task. After discarding what was not indispensable I described and illustrated one hundred such apparati!

With the advent of the extension bed these portable corrective apparati disappeared from the therapeutics of scoliosis. They have also experienced a revival in recent times. They are certainly not allowed an uncombatted existence. Voices are continually heard which deny the use of these apparati, indeed which describe them as directly injurious.

Here also we must subject the utility of these apparati to a critical examination in order to obtain an idea of their field of usefulness and the success which may be obtained with them.

An observation of the success is also here ambiguous.

When portable correction apparati are applied in the case of scolioses at first one has generally the impression that the desired favorable effect is being brought about. This effect soon appears to exhaust itself. One does not get beyond a certain degree with the correction and by no means seldom one observes after the first improvement, an aggravation of the deformity. Indeed the impression is often given that the scoliosis has finally become worse than if it had been left entirely without treatment.

How can we explain these observations again? In the first place the rapid results obtained are generally apparent corrections by which one should not allow one's self to be deceived. The further real correction results attained are not as a rule very great in the case of the usual apparati. As we generally use these apparati together with other remedies of the scoliosis therapeutics, it must appear doubtful whether we have to thank the portable correction apparatus for the gain which is obtained, or some of the other factors at work, notably the body's power of self-correction.

There are two real causes which come into question with regard to the poor results. The aggravation can be a result of the inactivity atrophy in the case of the supporting apparati, or it can be due to the false construction of the apparatus.

The first possibility is settled by what has already been said. Let us take the second.

I should like first to mention a form of the correction apparati which are particularly dangerous. I mean here the bandages of which the oldest representative is the Jörg braces. They are characterized by the fact that they attack a part of the spinal column lying partly above and partly below the part to be corrected and that they seek to straighten out the curvature by exercising a strain between these two points.

The pull of these bandages acts as a static loading of the spinal column. Now as primary scoliosis forming evil we have static overloading of the spinal column. It is quite clear that such a bandage must increase the disturbance of the loading equilibrium: the scoliosis forming process is excited. Further, gentlemen, make at any time the experiment on a bent rod of trying to straighten it out by this means. You will observe that the staff twists and bends and you will see all sorts of alterations except that to a straightening out. An urgent warning against the use of such bandages must be issued.

Just as the spinal column eludes the correction effect by elusive movements, so does it also in the case of most of the other portable correction apparati. Most of these apparati have the constructive error that the fixative part is not sufficiently worked out.

Every portable apparatus which is to serve the purpose of correcting a deformity must consist of two parts, of the fixative part, with which the deformed part of the body is held, and the active part which supplies the power effect for the correction. These two primary parts must bear the right relation to one another and also to the deformity to be corrected. The fixative part must really grip the part of the body and must so hold it out to the correction mechanism that it can really come to do the desired work. The deformed part of the body must not have the possibility of getting away from the correction mechanism and the fixative part must not be moved by the power of the correction mechanism.

The mistake that the fixative part does not perform its task is the mistake that runs through most of our scoliosis correction apparati.

This is primarily due to the anatomical conditions. The spinal column lies deeply embedded in the body. It can only be easily gripped at its two ends at the head and rump. Between these points we have only the ribs or soft parts to grip.

Most of the machines make use, as fixative part, of some rod construction or some corset such as we are accustomed to use in the case of the apparati for the reduction of the load on the spinal column. In order to see that one cannot even speak of an approximate fixing of the spinal column, gentlemen, in the case of such a construction, I recommend you to apply such a corset to a skeleton. You can then perform all the movements with the spinal column which it could carry out in life. Now if you switch in one of the many forms of correction mechanisms you will see that the spinal column possesses every possibility of eluding the work of this mechanism and that this work makes itself first felt in the dislocating of the fixative part.

We must not be surprised if we do not attain anything good with these apparati, indeed, if under their influence we obtain the well-known and undesired picture of a very pronounced rib deformity and a sort of lordosis formation at its highest point.

Must we, therefore, quite discard the portative correction apparati? Certainly not! But they must be correctly constructed.

Here we do not need to look for new corrective devices. We have more than enough of them. The point is, that we must have the most perfect imaginable fixative device as basis for the whole construction. In addition to this we must grip the spinal column firmly on the points where it can best be gripped, viz., at the head and the rump. If we exercise a strong extending strain between these two points we stretch the spinal column between its two extreme points, and, if we now cover the body with a closely fitting covering we have, if not an ideal fixing of the spinal column, at least one which makes the avoidance of the correction pressure very difficult. If we switch this in now in a suitable direction and do not give it a too great or too slight power then we may reasonably expect to obtain favorable results. We may hope to obtain results which may really be recognized as such and we may hope that unintended and undesired by-effects will not nullify or exceed the corrective results.

Whether this calculation is right or not must be shown by experiment. I have made such experiments and will inform you of the results of this extension cure.

The apparatus which I constructed for this purpose consists of a drill corset and an apparatus quite separate from it, which grips the body at the rump and the head. In addition it has pads which exercise the corrective pressure.

Recently I have simplified the apparatus by going back to the supporting corset and constructing the correction corset.

A head rest is built on to this corset which is further very firmly set on the hips. A pair of powerful side rods go round the shoulders with a ring. At the tops of the rings on both sides there is a serpentine of strong springy steel wire which runs up the side of the neck. The upper ends of these serpentines are connected to a ring which presses against the undersurface of the ball of the head. The side rods are so constructed that they can be made longer if necessary. In case of such a lengthening the corset presses against the crest of the *iliac* bone and the head and so effects the desired extension of the spinal column. A spring which presses a pad against the summit of the rib deformity serves as correction mechanism. The amount of the pressure as well as the direction are naturally to be altered. I have allowed the patient to wear this corrective apparatus the whole day. It was only removed for the massage to take place. At night the patient was laid in an extension bed.

What sort of results have we thus obtained?

At first, of course, very rapid and very beautiful apparent results. Severe scolioses appeared to disappear in the twinkling of an eye. But they were only apparent results. As soon as the apparati were left off, there was the deformity again. But after a time the result of the correction remained for a certain time.

I explain the difference so: In the first place the correction movement is only a movement of the joints and takes place in the spinal column. There are, however, pressures and strains in the material of the spinal column and these begin to alter its form. They do this first with the soft masses, the discs between the vertebræ. If there has been correction work here then the result remains a little while. But only for a while, for the contrary alteration in form takes place just as quickly and leads again to the full deformity. If we let the apparatus continue its work then, in the end, the vertebræ cannot avoid permanently the altering influence of the pressure and strain, and as far as these activities go, so far we must have a real correction. Such results are permanent if we do not allow ourselves to be robbed by a fresh breaking out of the force disturbing the loading equilibrium of the spinal column. In such a case even a really cured scoliosis would suffer a rapid relapse. That is, however, something quite different to when an apparent correction disappears.

I will not here go into what is done with regard to the danger of relapse in these cases. It corresponds to the preventive measures against relapse after the plaster dressing which I have to refer to later. I should like to add a few words about the usefulness of these cures. There can be no doubt that really noteworthy results can in fact be obtained by means of these cures. The results are even quite satisfactory. I have become particularly conscious of this just now after having again examined the whole of my material. In these cures it is an especially pleasant feature that such critical times do not occur as those we experience in the rectification cures immediately after removing the plaster dressing. The patients are generally quite willing to undergo the cure. There is, however, in the public and even among medical men a great feeling against plaster dressings, especially in the treatment of scoliosis. If we give the patients the choice between a correction in a plaster dressing and one in a correction corset, they invariably choose the latter.

In spite of this I have gone over from the use of these cures after having formed a firm opinion about them, and for the following reasons. The cures were too dear, as the patient must be retained very long in clinical treatment. Only one who is really an expert can perform anything really good with these apparati. Besides this, the slow course of the cure makes it a severe trial to the patience of doctor and patient, and in the length of the treatment the possibility of disturbances by means of uncontrollable influences is altogether too great. If I could find it possible to take these patients into institution treatment for a sufficiently long time, I should willingly revert to these extension cures again.

In any case I have learned from my experiments that one can do very much more with a portable correction apparatus than I used to believe and I have made use of this for my rectification cures by now adding a corset treatment in conjunction to the rectification cure. In still another point have the results of these experiments proved very valuable to me. Relatively often elder patients come to me, such as have passed their thirtieth to fortieth year and who have been burdened with a severe scoliosis from their childhood. They do not come to get rid of the scoliosis, but because they have got severe insufficiency symptoms in addition to their old burden, and are tortured by these. In these cases I am quite willing to give those extension corsets in addition to massage and plaster bed. I do this, of course, to combat the insufficiency symptoms. But also alongside the great relief which one can afford the patients, we obtain regularly correction results which in many cases are quite noteworthy. I have in some cases attained an extension of the spinal column of a hand's breadth and more and maintained them. I should like to recommend urgently this treatment to greater consideration.

Redressement.—I come now, gentlemen, to the best friend of the orthopedist: plaster of Paris. This friend without whom we really could not make any cure at all, remains true at our side, when it is a question of attacking scoliosis. But we must know how to use it.

The first who brought plaster or Paris into the treatment of scoliosis was Sayre. An historical retrospect is often very instructive! Sayre recommended the plaster jacket: the "Gypskorsett" as we are accustomed to name this thing in German. The idea of the plaster jacket, however, was not approximately that of a portable correction apparatus but, as Sayre emphasized in his publications, his plaster jacket was to be nothing more than a support. It was to do nothing more than maintain the correction position attained by means of a slight suspension. He hoped in this way to hinder the advance of the scoliosis and obtain a slowly advancing improvement.

It could not be otherwise than that the plaster jacket, counter to the expressed opinions of its maker should be used as a real correction apparatus. That came about quickly and from different quarters. The literature of the time bears witness to this. The study of this literature is of extraordinary interest. First all the writers are enthusiastic. The so long and so fruitlessly sought for means—it was at a time when the old scoliosis therapeutics had been utterly forsaken in favor of Swedish drill—had been found at one stroke. Every scoliosic was placed in a removable or nonremovable plaster jacket. At the same time energetic rectification operations were carried out. The successes were wonderful! All at once these reports stop. As much as had previously been written about this, one suddenly finds hardly a notice. Why and wherefore? That is only to be taken really from scattered and occasional reports.

The experiences which that period brought to light are these: In a part of the cases treated with the plaster jacket, a standstill, improvement and even cure of scoliosis was obtained. These favorable results were obtained with those scolioses where the same thing could have been obtained by other means: it was in the case of the forms which I have described as mild scolioses. The malignant scolioses which since the beginning had caused so much worry and for which a remedy had been sought with the greatest longing and which was believed to have been found in the plaster jacket—these malignant scolioses, when brought into the plaster jacket, might have been arrested in their aggravation curve. They could also be improved on the application of the jacket, in part even to a very great extent but sooner or later the stone began to roll again and ran downhill just as quickly or even quicker than before the application of the plaster jacket.

Taking one thing with another: the era of Sayre's plaster jacket ended with a great disappointment. The disappointment was so great that, at least here in Germany, it was looked upon as a mistaken treatment to handle a scoliosis in a plaster dressing.

It required a certain amount of courage to take up the apparently totally lost cause again. In spite of that I started with it in 1898. Calot provided me with the inducement. Wullstein also who without our mutually knowing anything about it, first might have received the incitement from the same quarter, again took up the plaster treatment of scoliosis. At the time Wullstein's works obtained much greater consideration than my publications. In particular the Wullstein rectification apparatus, which is excellently worked out, has been taken up in most of the greater orthopedic institutions. In spite of this the movement agitated by Wullstein and me soon died away. Although I always, at the orthopedic congresses, spoke up for the redressement of scoliosis and was supported in this by Wullstein, yet there were only a few colleagues as permanent disciples. Most of them returned to their old methods of treating scoliosis again after short experiments. Why? They had approximately the same experiences as those to which the use of the Sayre jacket led in its day. When I maintained that I had obtained other results, when I attempted to prove my assertions by reports, by showing patients, by photographs, I continually met with doubts. And it really was so and is so.

What is the reason for the difference? When I asserted that I had obtained favorable results with the redressement of scoliosis and when others could not obtain them, then I must explain where the difference comes from. This explanation is as follows:

The difference is, that immediately in the case of my first experiments, I took a sharp set of indications and always remained faithful to these indications. This indication position was correct as is proved by the success of my cures. But the importance of this indication position, its decisive importance for the success or the nonsuccess of the redressement cure has, up to the present, not been understood by most of our colleagues and still less taken into consideration.

The punctum saliens of the scoliosis redressement, gentlemen, is not whether a patient is treated in a Wullstein or Schanz or any other frame, or whether one applies a dressing according to Lovatt or Abbott, not whether one only carries the plaster dressing up to the head or puts the head in it also, not whether one cuts holes in the dressing, whether one includes pressure pads in it or not, no, these are all questions of minor importance, the critical factor which decides the success or the nonsuccess of the cure is the indication position!

As long as I have written and spoken about scoliosis redressement, so long have I been preaching to deaf ears. I repeat the same saying to-day and emphasize it with the whole strength of my voice. When you, gentlemen, listen to what I say here, you will be converted, you will no longer doubt my reports of the good results of the redressement, but you will obtain just as good or even better ones than those which I report.

What is this indication-position for scoliosis redressment? Now, gentlemen, this is the indication position which I have developed for you as the basis of the whole treatment of scoliosis.

Every time we treat a scoliosis we must distinguish between—I will repeat it here again—the scoliosis-forming process and the scoliotic deformity. Every treatment must be made up of efforts which tend to destroy the scoliosis-forming process and those which tend to correct the deformity. Remedies which are very good in the one direction by no means necessarily perform good work in the other. Indeed, what is here very suitable to the purpose may there be just as harmful.

This is the case with all the means of treating scoliosis and also with the redressement.

Redressement is exclusively a means of correction and only suitable for combating the deformity. In that direction it is the most powerful weapon we have in our therapeutical armory to-day. The redressement is, however, absolutely not in a position to do anything against the deforming process. Of course, as long as the dressing is on the patient, so long does it exercise a relieving effect on the spinal column and relieves it to such an extent that even the greatest disturbance of the loading equilibrium is totally put out of action. But in time the dressing is removed and then it is shown that instead of the spinal column having gained in its carrying capacity, it has suffered a loss of it. The misconditions in the loading set to work worse than ever before and the improvement which we had attained by the redressement is followed at its heels by the loss of the correction result. Indeed the aggravation curve after the sharp but only short straightening, begins to increase as we had not seen before and in a very short time has again reached the degree of deformity which the rectified scoliosis would never have reached had it not been treated.

These catastrophes are not unavoidable! Those who knew that in the redressement they took a sharp but two-edged sword in their hands, those who remained conscious of the fact that redressement can never form the whole scoliosis cure, but always can only represent single parts of it, those who keep in the forefront of their minds that besides the redressement, as in the case of every other scoliosis cure, the fulfilment of the second indication, the indication which the deforming process gives, remains open, they will not allow themselves to be surprised by such catastrophes, they will seek ways and means of working against them and these endeavors—I will bring my proofs for this—will not be fruitless.

I should like, gentlemen, to describe to you now the carrying out of the redressement as it has proved so successful with me.

First a few words concerning the choice of cases! The scoliosis redressement is a piece of heavy artillery which is only to be fired against objects worthy of it. Only severe deformities can come into question, that is only malignant scolioses which have already reached a high degree and which condition a vital disturbance of the bodily forces and the ability to work. Mild scolioses even when they reach the degree of a blemish do not pay by the gain obtained for the costs incurred. Besides this the deformity to be rectified must also have in sufficient degree the ability to be rectified. The impression must be gained at the trial dressings that the torsoskeleton is as formable as appears necessary for the desired success. The complete correction should be the standard of success desired. I will refer again to the fact that such a result can never be obtained but that we must content ourselves with a satisfactory result. According to my conviction it is a satisfactory result when we reduce the deformity from being a disturbance to the health to one which has not this quality.

What is otherwise to be regarded in the choice of the cases, I will lay clear after I have described the whole scoliosis cure as it becomes with the use of redressement. Here only a remark about the age of the patient. There is no certain age. In general better results are to be obtained in the case of young children than with older ones. That, however, is only a generality. Even after the time of growth has been passed one may obtain good results. In the case of a twenty-four-year-old patient, for example, I have had a very satisfactory result.

I subject the patient chosen for a redressement to a short preparatory treatment. By means of manual rectifications and by means of the stationary apparatus the spinal column is made mobile and the patient is accustomed to the use of the rectification frame. After eight to fourteen days the dressing is applied.

The patient is placed for this purpose in a frame. This frame permits of free suspension by the head and extension at the feet which is automatically spread equally over both feet. At first I do not suspend the patient so high as is shown in the diagram but only so high that he can stand on his toes. Then I apply a layer of strips of thin felt, Viennese wadding, and lint around the pelvis, trunk and throat. Now free suspension and foot extension take place. The first time with only slight force. As soon as possible a plaster dressing is applied beginning at the pelvis and continued up to the throat. At the same time the bandages are drawn very tight in the pelvis region, left a little slacker round the abdominal region and are drawn fairly tight round the thorax again. A cushion of cotton wool laid over the abdomen allows the necessary room for breathing. If the dressing which is reinforced by thin strips of wood, is strong enough, I, helped by one or two assistants, exercise a rectifying pressure with my hands and maintain it until the plaster has become hard. Then I place the patient on his feet again, allow the dressing to harden a little more and then put the patient quickly to bed, where, by means of warming arrangements, a rapid drying of the dressing is provided for.

The whole proceeding is carried out in quite a short time. The really critical time from the moment when the patient is suspended freely and extended, to the moment when he touches the floor again with his feet, lasts five to six, at the very most eight minutes. In addition to good preparations and good schooling of the attendants, the simplicity of my extension frame renders such quick working possible. Pretty as other such frames are, *e.g.*, the Wullstein, the proceeding of setting the patient in plaster lasts a disproportionately longer time. For this reason I have not been able hitherto to disassociate myself from my simple frame.

I do not cut holes in my dressings not even over the concavities. I believe that the fixative value of the dressing suffers in this way. That is after all only a minor question as is also the question as to the introduction of pads into the dressing which increase the correction effect by going further. I never introduce such contrivances into the first dressing. In the later ones I sometimes lay a felt cushion upon the rib deformity and through a hole over it I press it further against the rib deformity. It is quite easy to obtain in this way decubitus.

At first I change the dressing at short intervals. After three to four days, at most after eight days, the first change of dressing takes place with a vigorous repetition of the whole rectification proceedings. At similar intervals there follow further changes until I have gained the impression that I am not obtaining any increase in the correction result.

Now I let the dressing remain until, three months after the application of the first dressing, I remove it altogether. In the meantime dressing changes are only made for external reasons. In such a case I make a plaster bed and take the model for the extension corset, which takes the place of the dressing after its removal.

The patients feel very unhappy at first in the rectification dressings. However, in one to two days they regain their composure with the help of quieting means and expert care and are again quite lively. I keep the patient in clinical treatment during the whole time that the dressing remains on, for as long as the dressing is there, there threatens the spectre of the so-called dilation of the stomach.

In the case of fixed dressings round the abdomen, there arises now and again, as is well known, a peculiar, very dangerous disease in the digestive tract. A swelling up of the stomach and closure of the pylorus. Here there appear to act causatively slight digestive disorders and certain anatomical positional relations of the intestinal organs.

These conditions are introduced by a vomiting. The patient very soon gives the appearance of being seriously ill, and is really in serious danger. With my first patient with such an accident I narrowly avoided the calamity.

If these alarming symptoms appear, then the dressing must be immediately completely opened and the stomach emptied with the stomach pump. In this way the incident is settled. In the case of these patients the continuation of the rectification has to be given up. In spite of all precautions they generally get these conditions again.

When such untoward symptoms do not appear, the patients, as I have already said, feel surprisingly well in their dressings as soon as they are over the first bad days. The supposition which I myself had had when I first began the scoliosis rectification, that the great dressing would depress the general condition, a doubt which is continually heard to-day, proved to be false. On the contrary, these children who, on account of their serious scolioses, always show a general condition the reverse of pleasing, undergo a change for the better in their dressing. The complexion improves, the cheeks fill out and the appetite increases.

The cause of this favorable appearance, which was a very pleasant surprise for me, I seek to find in the fact that the rectification, in spite of the closely fitting plaster dressing, produces an enlargement of the chest and abdominal cavities and that the chest and stomach organs are placed in better working conditions.

A decubitus is an unpleasantness during the time of the dressing sometimes. In the case of the sharp gripping with the plaster dressing I cannot always avoid in all circumstances pressure spots. They are of course unpleasant but otherwise they are of no importance.

Now, gentlemen, I must describe to you the picture which the patients offer when they are taken out of the dressing.

When one gets to see the patient at the first change of dressing, that is at most a week after the application of the first plaster dressing, one is at first very pleased. The back is not to be recognized again. A wonderful correction results. But when tried for its durability it is quite a poor thing. In the shortest of times the liberated patient sinks back into his old deformity. The correction result was only caused by movements of the intervertebral joints and bending of the ribs. It was an apparent result, just like the other apparent results which we have already become acquainted with in the case of the other therapeutic remedies.

If the same trial is made with the patient after a few weeks, then we find that the result is much more permanent. We have then already a re-formation in the intervertebral discs, and if one waits a few months the correction result is so permanent that one cannot avoid having the impression that a re-formation of the vertebræ has taken place.

I imagine that during the redressement there is first only a movement—a bending is something quite different—and a bending of the ribs takes place. Further, I imagine that besides these there occurs a development of pulling and pressure strains in the mass of the spinal column itself and that the resultant of these pulling and pressure strains is a re-forming of the mass of the spinal column. I imagine the same thing for the effect of the redressment as for the effect of the portable correction apparati. The only difference is that the power effect in the case of rectification is much greater and that, therefore, its effect is much more intensive.

I even believe that the great pulling and pressure strains which, during the rectification, must occur in the material of the spinal column, produce a sort of reactive inflammation.

I should like here again to refer to an example. When we rectify a club-foot, there also, great pulling and pressure strains are set in action. If we take such a foot out of the dressing before the resultant of the strains has been arrived at, it gives us the impression of a condition of inflammation: it shows swellings, sensitiveness to pressure, the patient is not able to stand upon it.

That something similar goes on in the spinal column, certainly without our being able to see it so directly, I conclude from the behavior of patients on being taken out of the dressing. Already at the time when the trials of the permanence are made, which I have just described, it is to be noticed that the patient does not by any means like the free standing exercises. He looks for support and is very thankful when we allow him to lie down or place his head in the suspension sling. This necessity of the spinal column for support which is thus expressed does not generally become less with the time of the dressing but rather stronger, and it reaches a degree which cannot be explained by inactivity atrophy alone. There also occurs an inactivity atrophy in the redressement dressing. But in other cases where such a thing was to be supposed, I have never seen that it increased to a momentarily visible need for support. Therefore I believe that, under the influence of the sharp pulling and pressure strains which are set in action by the redressement, a reactive inflammation occurs in the spinal column and in this way a loosening of the bone material, and that, during the period of this loosening, there is present the need for support in the case of the patient.

Be that as it may, at any rate, just as little as a club-footed child is able to walk straightway, when taken out of the plaster dressing at the end of the redressement cure, just so little can the scoliosis patient whom we take out of the plaster dressing after about three months walk away and take his fine correction result with him. The liberation from the dressing, so long wished for, brings a great disappointment with it; he cannot hold himself upright at all: the spinal column is not in a position to carry the burden of the body—not the muscles of the spinal column but the bones of the spinal column.

With this we come with our cure to an exceedingly critical point.

If we load up the liberated spinal column again, if we give it approximately the normal burden to carry then a miscondition of the loading relations again sets in, and this results in the relapse of the deformity. The trunk sinks rapidly to the rectified scoliosis again, indeed the relapse exceeds the degree of the former deformity very much. What can we do to avoid this danger?

We can now only place loads on the spinal column at the same rate as it regains its carrying capacity after the removal of the plaster dressing.

In this case I proceed as follows: Immediately after removing the plaster dressing, I place my patients in a plaster extension bed, which I had prepared for them during the time of the dressing. At first I let them lie quite quietly in this bed similarly to the treatment of a severe case of spondylitis in a plaster bed. The patient only comes out of it for the washing and massage indulged in during the lying. Further for the trials of the already begun and now finished corset. These trials are of course performed under suspension.

Immediately after the removal of the plaster dressing I, at first, only use supporting corsets. They were leather drill corsets, hip pressure corsets and principally the corset previously mentioned. With this corset I generally let the patient wear a simple head support.

After I had learned that considerable improvements could be attained in severe scolioses by the use of portable correction apparatus, I went over to giving, after the removal of the plaster dressing, not a simple supporting corset, but a correction corset. After I had gained the impression that a loosening of the materials of the spinal column takes place under the plaster dressing, I believed myself justified in supposing that a favorable time had arrived for the work of the portable correction apparatus and that one, by means of these combined cures, must attain better results than with the simple redressment.

Pictures which I reproduce when speaking of the results of redressment will prove that I had not deceived myself.

I, therefore, now carry out the treatment after removal of the plaster dressing as follows: The children have an extension plaster bed and a correction corset. During the early part of the time they only wear the corset a few hours daily. They are continually under the influence of the corset or the plaster bed except when being massaged, electrically treated, or washed. By degrees I have the corset worn the whole day long, while the plaster bed is kept for the night.

Such a difficult cure is only possible when the patient is in stationary treatment. As the stationary treatment is also necessary during the time the dressing is on, these rectification cures make quite a long stay in the institution necessary; five to six months is the minimum.

I do not send my patients home until I have the impression that the spinal column has some sort of carrying capacity again. Some one in the family must then be made acquainted with the use of the corset and the plaster bed and must learn massage. The further carrying out of the cure at home consists in the continuing of the use of the appliances, corset and plaster bed and in carrying out twice daily a vigorous massage of the muscles of the back.

For checking purposes I get the patients to present themselves in my surgery first at short intervals and then at longer intervals.

The impression which I have of the certainty of the result acts as a guide to me in my further prescriptions. The corset is first changed. I remove the extension head rest and replace it by a simple ring head rest, at the same time the pressure pad is removed. After a time this little head rest is only worn for an hour at a time and is finally laid aside entirely. With this I come to the simple corset model which I generally use in the treatment of scoliosis. In time this is also left off. The plaster bed and massage I retain the longest. I continually impress upon the parents of my patients that the massage must be carried on with never-ending perseverance if the end is not to be a disappointment after all.

On the other hand, I have gymnastics indulged in but very little in the after-treatment. In connection with the massage I prescribe breathing exercises immediately on the removal of the dressing. Then later come the well-known trunk exercises which can be performed when lying on the stomach. If the patients do not show any further need for support, we cautiously continue our way with the use of appliances which permit exercises without a burdening of the spinal column and finally arrive at free trunk exercises. If at a later time a corset atrophy develops, or if I am not satisfied with the respiration, then I insist that from time to time a few weeks, gymnastic cure should be made. I demand, however, that this takes place under my eyes. I have a fear of the so-called gymnastic after-treatment at home which I cannot check. Have I not mentioned above that I consider gymnastics a not uninjurious remedy in the case of malignant scolioses, and I can only repeat it here with increased emphasis.

Final results of the redressement. What the redressement results look like immediately after the removal of the plaster dressing I have already described. I have further to say what becomes of them when the cure is continued in the way set forth.

I would give a great deal, gentlemen, to be able to say: "Now, gentlemen, carry out the cure as I have described, and you will not experience any disappointments; you will permanently maintain for your patients the correction result that you took out of the plaster dressing, or you will even improve on it. As much as I should like to say so, gentlemen, I cannot. I must pour a great deal of water into the wine and report many disappointments.

When we, gentlemen, remove the patient from the dressing, we have, even in the most successful correction, by no means attained the total extinction of the scoliosis or even an overcorrection as in a club-foot in approximately the same stage of the cure. There always remains a remnant of the scoliosis. Also we shall never be able to entirely remove the deformity. Dangerous as the "Ignorabimus" is in science, here we may say it, for the anatomical conditions of the spinal column are just a given quantity and they are so unfavorable for the application of mechanical forces that a complete correction results in the case of the scoliosis redressement is impossible.*

If we could at least only retain the picture which we take out of the plaster dressing, we might be quite satisfied. But even that is not possible.

The correction picture that we take out of the dressing is composed of two factors. It is composed of the re-forming that has taken place in the spinal column, the real correction and also there is an apparent correction which has taken place within the possibility of motion of the spinal column. By means of the rectification we produce joint movements in the direction of the bending back of the deformity. What part of the deformity disappears by this means is naturally apparent correction which must again be lost. When we rectify a club-foot, we overcorrect it as much as the joint movement, which overcorrection is again lost and must be lost.

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* It was a peculiar coincidence that at the time when I wrote this, the news came from America that Abbott had discovered a method of bringing about an overcorrection of the scoliotic spinal column and of obtaining correction results which I here describe as unattainable. At the orthopedic congress this year we have had opportunity of proving the truth of this information. Unfortunately I did not need to correct my "Ignorabimus" because of it. The alleged overcorrections of Abbott are nothing more than thorax deformations. Abbott does not attack the spinal column as we have hitherto done, but the thorax and he presses the thorax round the spinal column into such a form that it simulates a correction or overcorrection of the scoliosis. With the methods of carrying out the redressement of scoliosis which have been hitherto employed such apparent corrections are possible to obtain, it is only necessary to seek out the suitable cases.

Therefore, gentlemen, there are no complete scoliosis corrections with the redressement and there will never be any, and also the correction picture which we take from the rectification dressing, cannot be retained in all completeness. In place of the absolutely necessary loss, a partial or even a complete equalization or even a gain may certainly be attained after the removal from the plaster dressing by the use of the correction corset.

If the danger of the primary relapse has been avoided—it is possible to say this when the correction result has been carried on to six months after the removal of the plaster dressing or the correction result—even then everything is not yet won. The secondary relapse can even yet destroy the correction result and a result which appears first class six months or even a year after the correction may after years look really bad. The whole thing is just whether we succeeded in giving the spinal column back its normal carrying capacity in the after-treatment or not. In the first case we have a permanent result and in the second with natural necessity a relapse.

It is not possible to say exactly what time is needed before the danger of a late relapse may be regarded as past. According to my experience I do not dare to speak of it as being over for at least five years.

Gentlemen, if I wanted to sing a hymn of praise to the scoliosis redressement, I would here have a suitable opportunity. But I will not raise this hymn. Instead we will take a short look back and seek for an appreciation of therapeutics in scoliosis redressement.

In the first place I repeat: Redressement is a means which can only fulfil one task in scoliosis therapeutics. Redressement can never gain the importance of the whole of the cure of scoliosis. The measures which have always to be taken in addition to the redressement do not lose their importance on its account in any way. They are not to be mentioned as an after-treatment to the redressement.

As a means of correction redressement excels all other means competing with it.

The correction result may be, in a number of rectified cases, permanently maintained, indeed even improved. What can always be attained is a sharp descent of the aggravation curve and quite a considerable flattening of its secondary rise.

We must, however, still add that the use of redressement by a medical man demands great interest and full understanding of the treatment of scoliosis, that the patient must be prepared to stand the by no means slight unpleasantnesses which occur in the long period of treatment and must also be prepared to make the necessary financial sacrifices, which are considerable.

From the last sentence I should like to complete what I have said about the employability of redressement in a very important direction.

As trial material for new methods of treatment, gentlemen, we like to choose policlinic and clinical patients: This material is absolutely unsuitable for the scoliosis redressement. You will seldom find the necessary intelligence and perseverance there—never the financial strength.

When the care of the cripples opens special institutions for the treatment of scoliosis, then the redressement of scoliosis will also be attainable for the lower classes of the people. Until then, however, we will keep our hands away from them, for we only get blows in the face. You may believe me, gentlemen, I speak from a rich experience!

Now enough of redressement!

We have now come to the end of the investigation of the means which come into question for the treatment of scoliosis.

We have laid out all the cards we can play in the treatment of scoliosis and given them their values. Perhaps it would be of interest to you, gentlemen, to see a trial game which I will play before you in short, rough features, what lessons I learn from that which I have shown you and how I treat scoliosis in practice.

Let me begin with the great mass of the youthful scolioses, with the mild ones, in these I see my first and most important duty in explaining to the patient and his parents the mild nature of the complaint. It is always a great pleasure to be able to lighten the heart of a worried mother. Further I investigate the patient's general condition of health and prescribe what is to be prescribed. Generally it is an alteration in the diet.

Most of the patients in question are young girls and these again are generally overfed and badly fed with milk, cod-liver oil, sanatogen, iron and other similar good things. I order a varied, principally vegetable diet with a preference for fruit and fresh vegetables. I get them to tell me how the patient spends his day and provide for the avoidance of mental and bodily overstrain and for sufficient time of rest. Where I get the impression of unsuitable home relations I endeavor to get the patient into other surroundings for a few weeks.

Locally I always prescribe the use of back massage. I train the mother or some other person of the household in it and have it carried out according to specially printed directions once or twice daily with the strictest regularity and absolute perseverance.

If clear insufficiency symptoms are present, or if the case is so, that a clear difference in the hips or even a slight rib deformity is present, then I give, in addition, the supporting corset which I have previously mentioned and a plaster bed. I very seldom propose gymnastic treatment. Generally when it is desired I refuse it.

I only propose gymnastics in the case of strong children without or with only very slight insufficiency symptoms.

In the rare cases where I accept such cases into my institution, I let them do a little gymnastics with great caution in order to provide the children with the necessary bodily movement.

On the special desire of the parents I accept the children to my gymnastic cure if they live in the immediate neighborhood of my institution. I absolutely refuse when the homes lie in distant parts of the city or even outside the city, as the journey to and from the gymnastic lesson tires the children a great deal too much and undoes what the gymnastics might have done.

Of the scolioses which I do not count under the mild cases, I will first describe the rachitic in their therapeutics. Provided that they come to me in a florid stadium I prescribe antirhachitic general treatment, which may proceed in two directions. I very seldom see rachitic hunger children. These get a plentiful diet rich in fat and albumin. On the other hand, I see very much oftener overfed rachitic children who have never had anything but milk, cod-liver oil with and without phosphorus and such things. These again I put on a vegetable diet, without milk and with very little fat and albumin, a prescription which I should like to recommend for many other cases. In every case I then give these rachitic scolioses a plaster bed and if they are sufficiently young I let them make a lying cure something like in the case of spondylitis. If they are already larger and no more to be permanently kept in a plaster bed they get also a supporting corset. Of course here again massage is carried out regularly.

Now I come to the bulk of the malignant scolioses.

Here I will first mention the adult patients who, burdened with severe insufficiency symptoms, come to me. I give these a supporting corset, generally also a plaster bed, I prescribe massage and warm applications to the painful points. Often I also give these cases phosphorus.

With malignant scolioses at an early age I consider it my duty as a medical man to explain the whole serious meaning of the complaint. Just as much as I console with the mild scoliosis, just so energetically do I paint the future of the patient with the malignant scolioses even when the deformity is only in its beginning. I do this first from personal motives in order to avoid later reproaches and then because the patient will only follow the advice which I give him when the full meaning of his complaint is pointed out to him.

The real prescriptions generally consist of general orders in the first place, as with the mild scolioses. Only I try to get the malignant cases away from the usual home surroundings. Poor plants often thrive better when set in a different soil!

For the local treatment my prescriptions are different, according to the importance of the already present deformity and what means appear to me to be indicated in the case of correction treatment and which are available.

If there is no particular deformity present or if the rectification for any reason does not come into question, then I give a supporting corset eventually with a head rest and a plaster bed with extension.

Massage of course for all cases. With the gymnastics I am still more cautious than with the mild scoliosis.

I apply the redressement where the deformity has reached such a high degree that it has an injurious effect on the general health; where there is a sufficient ability to be rectified with the deformity and where the external conditions appear to me to guarantee the practicability of the redressement cure.

That, gentlemen, is in short my scoliosis therapeutics.

We have now arrived at the point to which I wanted to lead you. I have told you the goal of my remarks; we want to get an opinion as to what is still wanting to us in the scoliosis therapeutics and to keep a look out as to which way the road goes on.

What we can do in scoliosis therapeutics I believe I have shown without being influenced by the favor or the hate of the parties.

What is wanting?

We may be contented with the capability of our therapeutics with regard to the mild scolioses. The mild scoliosis is and remains a bagatelle. It does us the favor of coming to a standstill and often to a correction without any treatment, with any treatment and often in spite of any treatment.

We hold the mastery of the rhachitic scolioses in the same way. It is only a question of treating the patient at the right time.

With the constitutional scolioses the balance is not so easy to strike. Let us name our positive performances in connection with it, we can in all cases bring about a retardation in its progress. In a certain number of the cases we can also succeed in bringing the deforming process to a standstill completely. Even this result we cannot guarantee. It is based too much upon certain unknown processes in the interior of the body of our patients.

The ability of being corrected in the case of severe constitutional scolioses is limited by external, particularly social reasons. It is also limited by the anatomical conditions, by the position of the spinal column, on account of which there is always a remnant of the deformity. This remnant is unimportant, we can take it in the bargain. Also we can get on with it when many patients come to us for treatment when the deformity is overripe, that is when it has reached a too advanced degree and when the bone has become too hard. He who does not go to the doctor at the right time must bear the consequences. Now comes the sore point in the therapeutics of the constitutional scoliosis. It is that we are not in a position to maintain the result of a rectification permanently with certainty.

At one time we can do it and at another time we cannot. And we have also worked in the one case exactly as in the other and the one case appeared to lie just like the other.

That we succeed in maintaining the rectification result in some cases proves that we do not stand before an "*Ignoramous*," but an Ignoramus is present.

The "Ignoramus" is so far limited that we can say the rectification result can be permanently maintained if we succeed in restoring the loading equilibrium of the spinal column.

But how this loading equilibrium is disturbed in these constitutional scolioses—that, gentlemen, is what we do not know. And still less have we a remedy for the prophylactic avoidance of this disturbance or of cutting it out by specific therapeutics.

The admission is saddening. Just at the most important point our knowledge and our art breaks down. And yet this admission is a gain, gentlemen, for it points out the direction of our further researches.

Rational therapeutics can only be based on a knowledge of pathology. The possibilities of therapeutics are limited by the exploration of pathology.

If we have such a failing to chronicle in our scoliosis therapeutics to-day the fault is not to be found in a scrappy working out of the therapeutics. What is possible to attain therapeutically with our knowledge of the pathology of scoliosis that has been attained by the present-day orthopedics. It is not a question of extending the therapeutic methods for further progress. Gentlemen, do not waste your time in the search for new gymnastic exercises. Do not construct new gymnastic appliances, new rectification appliances, do not dispute whether Hessing's corset is better than a leather or a celluloid one, do not debate whether you will apply a plaster dressing after Wullstein, after Lovett, after Schanz or after Abbott, all these questions are details, not worth a stroke of the pen. If you do this or if you do that you will all attain the same, and will all end at the same point.

The further advance of scoliosis therapeutics, the final solution of the scoliosis question is not to be found in the gymnasium, in the workshop or in the operating room, it will not come at all from the orthopedic institution. *The next word in the scoliosis question must come from pathology.*

We ask it the question: The cause of constitutional scoliosis must be a disease process which severely diminishes the carrying capacity of the vertebral bones. What is the nature of this process?

The answer hitherto given: it is a rhachitis, a so-called late rhachitis, we cannot recognize as satisfactory; for the clinical procedure, the clinical finding is quite different in the case of the constitutional and the rhachitic scoliosis.

There is no doubt that this question can be answered, as far as I am concerned. Let us regard the old questions which just in our time have been answered in the sphere of pathology. The answer to our question has never been sought for systematically.

When the question is answered we may also hope to find a means for a specific treatment of the complaint and so to come to a real etiological treatment of the malignant youthful scolioses.

I have come to the end, gentlemen. What orthopedics performs to-day in the treatment of scoliosis, we need not be ashamed of. What was set us to work out on a given basis, we have worked out. The scoliosis question is, however, not yet solved. It cannot be solved until a new basis for our work is given us.

XXXIX.

CLUB-FOOT, A STATISTICAL NOTE.

BY ALBERT EHRENFRIED, M. D.,

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Two years ago I published some statistics* based on the study of 232 patients with club-foot who visited the Out-patient Department of the Children's Hospital in the five years ending January 1, 1912. Some of the facts which this study demonstrated were novel and interesting, and undoubtedly of a certain value in helping to clear up the murky atmosphere which envelopes the etiology of this and other congenital deformities.

With the idea of checking up these observations, I have gone over the cases which have appeared at the clinic in the two years ending January 1, 1914, making a second series 110 in number. During these two years patients with club-foot have constituted 6 per cent. of the clinic, and most of them have been under my observation.

For ease in comparison I have tabulated the figures, as follows. In the first column will be found the percentages for five years reported in my original article, in the second the percentages found in the two years 1912 and 1913, and in the third the percentages based on the total figure of 342 cases seen in seven years.

All cases not equino-varus are classified under 'other forms.' This classification includes fifty-two cases of calcaneo-valgus, ten cases of valgus, six cases of varus, four cases of equinus, two cases of calcaneus, one case of calcaneo-varus, and one case of equino-valgus. With rare exception all the cases of calcaneo-valgus were of the potential type, which I have described elsewhere. There were four cases of equino-varus of one foot and potential calcaneo-valgus of the other.

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* Ehrenfried, "The Etiology and Occurrence of Club-foot," *Jour. Amer. Med. Assoc.*, 1912, LIX, 1940.

	1907–11, per cent.	1912–13, per cent.	Total, per cent.
No. of patients	232	110	342
Equino-varus	80	70	77
Other forms	20	27	22
Combinations	1 case	3	1
Male	69	73	70
Equino-varus	71	80	74
Other forms	61	55	59
Female	31	27	30
Double	56	56	56
Equino-varus	55	52	54
Other forms	61	60	61
Single	44	44	44
Right	59	55	58
Equino-varus	58	60	59
Other forms	61	44	55
Left	41	45	42
Hereditary	5	5	5
Equino-varus	100	100	100
Other forms	0	0	0
Multiple preg	4	1	3
First born	30	40	33
Equino-varus	28	37	31
Other forms	35	50	40
Difficult labor	16	29	21
Premature	4	1	3
Illegitimate	2	5	3
Other deformities	13	20	15
Equino-varus	11	21	14
Other forms	22	20	21

It will be seen that in the main the two series corroborate each other. Some of the items show higher figures in the second series than in the first, undoubtedly because more care was taken in noting these points in the histories, our attention having been directed to them by the previous study. Accordingly the figures in the second column for 'first born,' 'difficult labor,' 'illegitimate,' and 'other congenital deformities' are probably more nearly correct than the final figures.

No case of club-foot has been seen in a colored child during the seven years, although colored children are frequent at the clinic.

There is probably some significance in the fact that all the cases giving a history of the occurrence of club-foot among near relatives (5 per cent. of the total) were cases of equino-varus. 80 per cent. showed the double deformity.

The various types of other congenital deformities met with complicating club-foot, and their relative frequency, are shown by the following table. The figures represent patients, not deformities. Many of the patients showed more than one deformity: eight spina bifida, three scoliosis, seven hydrocephalus, nine club hands, one extended hand, three contracted upper limbs, six contracted knees, one extended knee, four dislocated knees, three dislocated hips, two curvature legs, two broken bones, legs, twelve other developmental deformities, arms or legs, two congenital scars (amniotic), three cleft palate, two vascular tumors, four umbilical hernia, one hydrocele, one undescended testicle, one imperforate vagina, six mental deficiency, and two patent foramen ovale (blue baby).

It is not my purpose here to take up again the interpretation of these findings. Those interested are referred to the article already mentioned. The more significant points are:

1. Equino-varus occurs three times as often as all other types of club-foot. The next most common form is potential calcaneo-valgus. Other types are rare.
2. Males are affected two to three times as often as females; the percentage of males is higher in equino-varus than in the other forms.
3. More than half the cases are double; the percentage is lower in equino-varus than in the other forms.
4. Of the single cases, more than half are right sided.
5. Five per cent. of all cases show heredity; of these all are equino-varus, usually double.
6. Club-foot occurs three times as often in twins as in single pregnancies.

7. More than a third of all cases occur in first born; the percentage is lower in equino-varus than in the other forms.*

8. Labor is difficult in approximately one-fourth of all cases.

9. Three per cent. are premature.

10. Three per cent. are known to be illegitimate.

11. Other congenital deformities occur in about one-fifth of all cases.

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*In this connection it is interesting to note that the inferior quality of first born children, and their greater susceptibility to hereditary taints seem to have been established. See *Jour. Mental Path.*, 1907, VII, 228, and *Eugenics Review*, 1913, V, 252.

XL.

PSEUDOARTHROSIS PRODUCED BY INTERPOSING SHEET SILK AND BAYBERRY WAX.*

BY ROLAND O. MEISENBACH, M. D., BUFFALO, N. Y.

Ankylosis of the joints usually presents itself to us as: (a) Apparent. (b) Real.

Whether ankylosis has been caused by infection or other processes does not concern this paper as long as we are certain that there is no active process in the joint to be attacked, but that the ankylosis is a residual outcome of a former disease. In the apparent type of ankylosis we may have fibrous union of the adjacent bones, with or without loss of articular cartilage. In this type we usually find a line of demarkation between the adjacent bones, and if a simple manipulation without incision is chosen, or if an incision is made and the chisel set between the adjacent bones, the joint usually breaks along the line of demarkation. This is very frequently illustrated in the hip-joint, the X-ray showing clearly the line between the acetabulum and the femur, even though the joint is immobile and clinically presents the appearance of an ankylosed joint. If an attempt is made to produce a moveable joint it is sometimes accomplished by manipulation.

In the real bony ankylosis, the problems which present themselves to the surgeon are entirely different; that is, we usually find that the adjacent bones have amalgamated, have lost their articular cartilage and have become one structure by virtue of actual bony formation. The surrounding tissues and capsule are usually atrophied and adherent, and the sinovial lining of the joint physiologically arrested. It is this type that the author wishes to present to-day.

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* Read before the American Orthopedic Association at Washington, D. C., May, 1913.

The very excellent work on ankylosed joints done by Bradford, Baer, Murphy, Osgood, Taylor, and others, is too well known to require review at this time. This paper is intended chiefly as a preliminary one, and may be interesting to some of us who have not been entirely satisfied with the results obtained by the introduction of animal membrane as a means of preventing adhesions in ankylosed joints. Prepared animal membrane seems to act as a postoperative irritant, and the reaction in the joint seems to be greater than one would like. This is probably due to the chromic acid which is thrown off in the process of resolution. Fascia interposed is quite uncertain in cases of real bony ankylosis, as is also muscle-flap interposition. In the latter, it has been the experience of various surgeons that considerable pain is experienced by the individual many months after the operation. It has been generally accepted that fatty tissue should be interposed between the joint surfaces, and also that it should be nonirritant. The conduct of silk in tissue, especially when it is prepared by the method of Lange, namely, sterilized and then saturated in corrosive sublimate, dried and then immersed in paraffin, is known to every surgeon.

A few years ago, I had occasion to inject bayberry wax into a joint, and was impressed by the fact that it produced very little postoperative reaction as compared with the mineral paraffin. I have since used it in four cases, obtaining results sufficiently satisfactory to warrant this paper: Two knee-joints, an ankle- and an elbow-. The cases were all the result of some infection, and of long standing, in which the disease had become quiescent; except the ankle case, which suggested an active process.

To best illustrate the modus operandi, I will cite the four cases:

CASE I (Figs. 1, 2 and 3), referred to my clinic by the Skin Department; a girl eighteen years old, robust, with left knee permanently flexed at right angles, with the following history:

Ten years ago she fell and her knee gradually became stiff, "that it had been broken by another surgeon at that time, but that it would not remain straight." The physical examination showed the left knee permanently flexed at right angles, the surface temperature below the knee subnormal. About 10 cm. above the internal malleolus, a round, punched-out ulcer about 4 cm. in diameter had been present for two years. The dermatological diagnosis of this was given as trophic ulcer; the Wassermann test negative. The radiograph showed fibrous ankylosis with the line of dermarkation present and the patella adherent. The internal condyle was considerably elongated

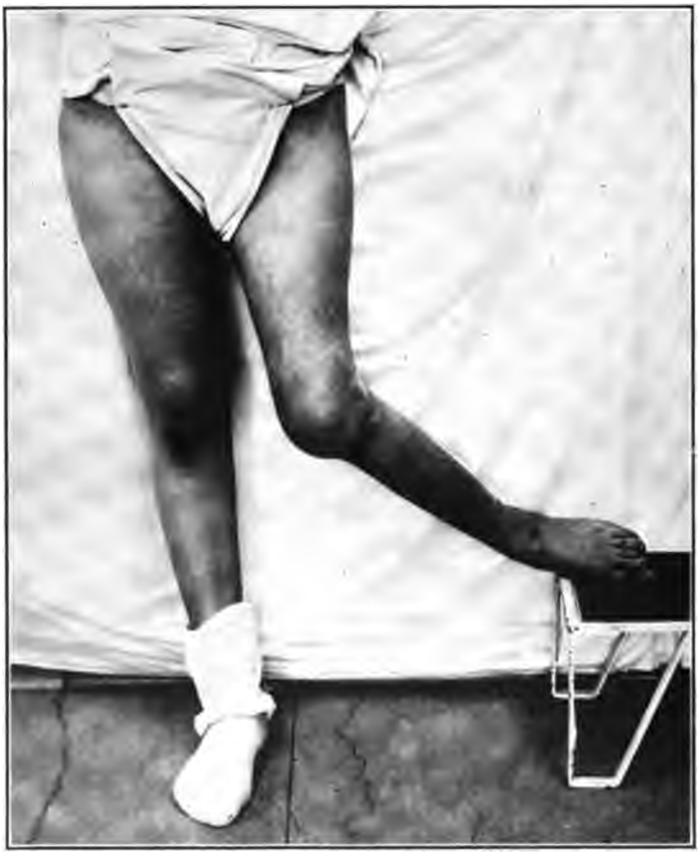

FIG. 1.—CASE I. Resulting knock-knee after genuclasis. Due to elongated inner condyle.

and there persisted a slight subluxation of the tibia and fibula. A genuclasis was done, with the result of breaking the adhesions and straightening the knee in the anterior, posterior plane. The length of the internal condyle prevented the classical operation of osteotomy above the joint. Owing to the elongated internal condyle, a marked knock-knee resulted, so that the patient could not use crutches. The author then determined to attempt the operation of reconstructing the joint rather than have the limb amputated, as was suggested by some of the surgeons. By means of a horseshoe incision, the entire knee was exposed. It was found that no cartilage existed, and in its

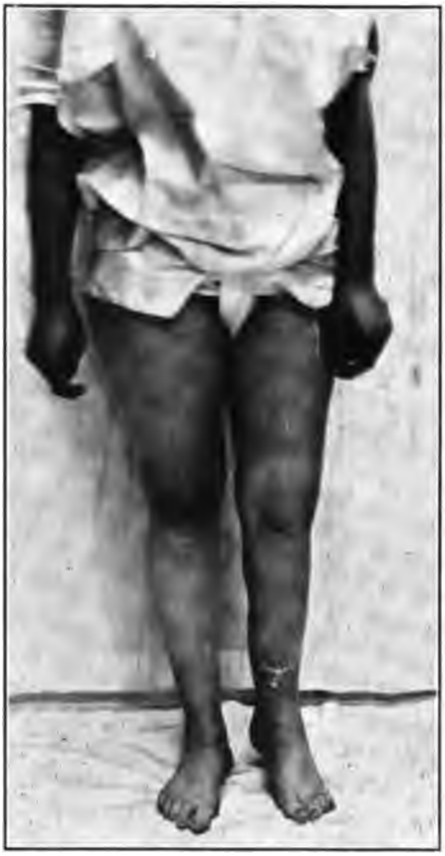

FIG. 2.—CASE I. After remodeling of joint and interposition of sheet silk with bayberry wax (about one year after operation).

place was a fibrous tissue irregularly distributed over the entire bony surface of the femur and tibia. The patella was adherent to the femur, and was chiselled off. After chiselling off the patella and removing it, the quadriceps was anchored to a portion of the capsule. By means of the chisel and bone rasp, the internal condyle was cut off and the femoral surface remodelled. Prepared sheet silk and bayberry wax were interposed. In less than three weeks after this the trophic ulcer disappeared. Convalescence was uneventful with the exception that after about three months a small sinus made its appearance. This was easily controlled by means of tincture of

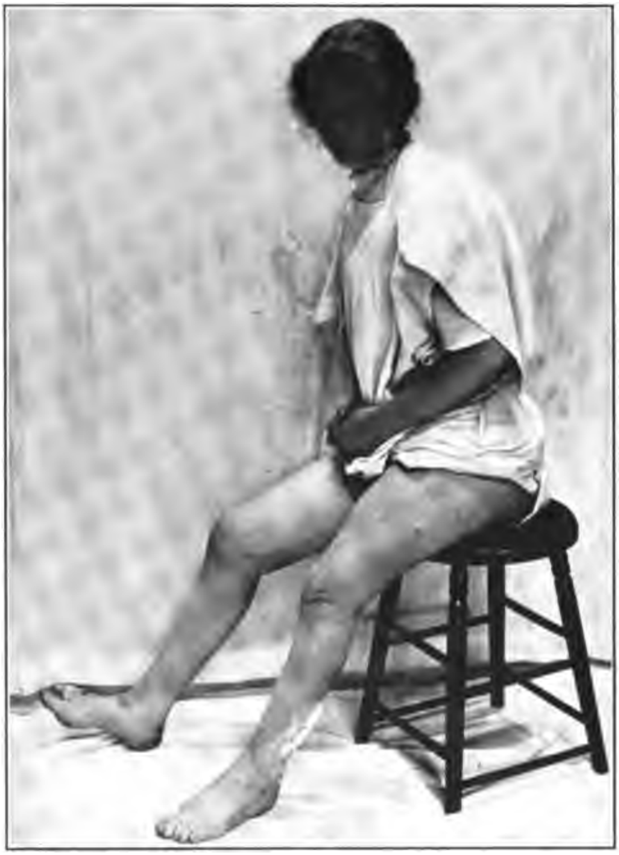

FIG. 3.—CASE I. Same as Fig. 2 with knee slightly flexed.

iodine dressing. It is now fourteen months after the operation. The patient has about twenty degrees of flexion. Owing to the absence of the patella, a check brace is worn and the patient is now able to bear considerable weight upon the left limb without discomfort.

Case II (Figs. 4 and 5), lad fifteen years old, deaf and dumb, referred to me with the following history: Two years ago had left elbow-joint scraped, the resultant ankylosis holding the arm in almost complete extension, so that he was unable to bring his hand to his nose (Fig. 7). The X-ray (Fig. 9) shows bony ankylosis between the ulna and the humerus, no line of demarkation present, and therefore it was necessary to saw through the solid bone and improvise a new joint. This was done by means of the bone rasp, and a dove-tailed joint established, the prepared sheet silk and bayberry wax interposed between the adjacent surfaces and the remnant of the capsule closed tightly. Over a year has now elapsed and the patient has about fifty degrees of motion and is able to do his work.

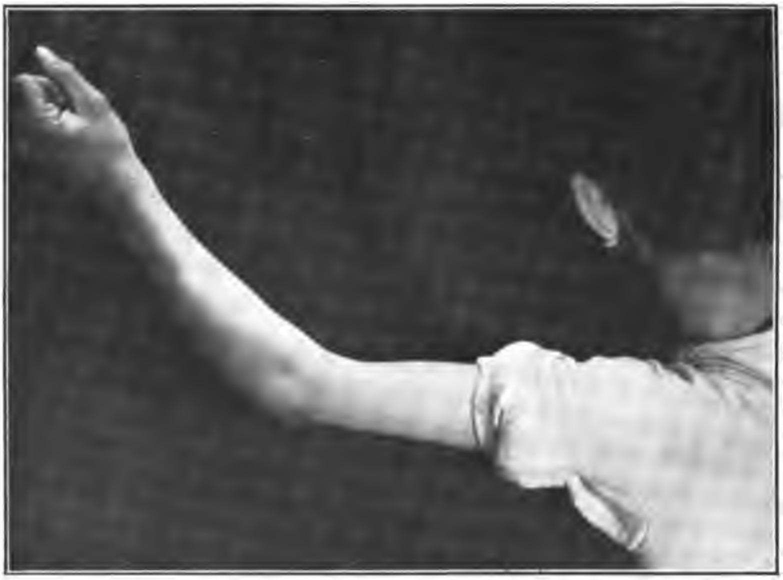

Fig. 4.—Case II. Arm held in the position in which the elbow-joint was ankylosed before operation. Note that the brand cannot be brought to the face or extended further. (True bony ankylosis.)

Case III.—A woman forty-four years old, referred to the clinic by the Social Service; woman a foreigner, unable to speak English; history vague, except that while in her native land her left ankle was operated upon four years ago. Physical examination showed a healthy appearing woman, with left foot permanently held in about ten degrees of dorsi extension; patient unable to bear weight on foot, owing to pain in the ankle; slight spasm of the tendo Achilles present; no lateral motion. Arthrodesis was first considered, but after opening the ankle-joint, the cartilage of the tibio-astragaloid joint was found loose within the joint. After removing this and washing the joint, a sheet of prepared silk and bayberry wax was interposed and the incision closed tightly. A slight sinus developed later. While on my vacation the patient fell into the hands of another man who, not knowing what had been done in the case, removed some of the silk. Slight secondary infection resulted. After this subsided, I injected bayberry wax. At present the patient is under my treatment and the sinuses, which are very small, under control.

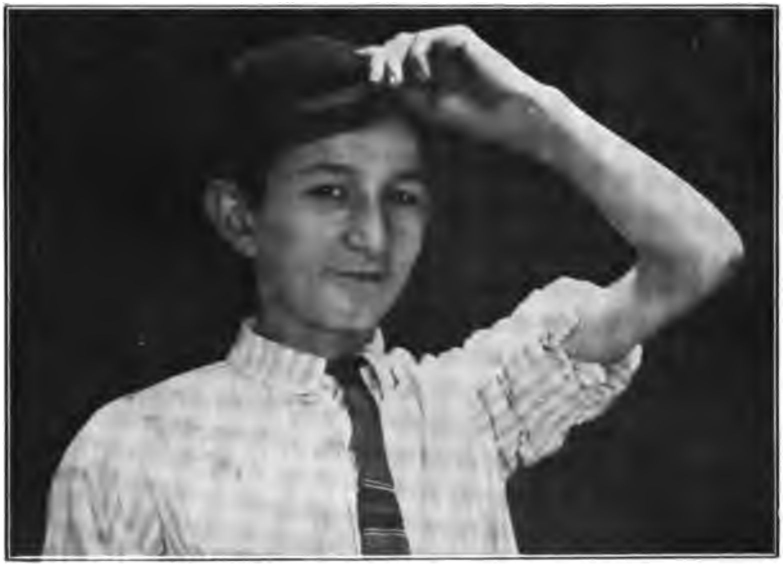

FIG. 5.—CASE II. Fourteen months after operation. Note free motion at elbow.

CASE IV.—An engineer, thirty-eight years old, with the history of having injured his knee five years ago. Infection set in, and his joint had been aspirated four or five times. Physical examination showed a poorly developed and nourished man, apathetic facies, with the knee flexion about thirty degrees and ankylosed; temperature normal. X-ray showed ridges of bone passing between the tibia and femur, suggesting that true bony ankylosis was rapidly making its appearance, but was not complete. Under nitrous oxide and oxygen, a genuclasis was performed. At a later date, by means of a lateral incision, the knee-joint was opened. The capsule was found bound down and hard, the consistency of parchment. The knee was then flexed and bayberry wax injected. This case is still under treatment, and although he has about twenty-five degrees motion, I wish to reserve the prognosis.

In the preparation of the sheet silk and bayberry wax, the silk used should be of the thinnest China silk, prepared after Lange's method given above, excepting the immersion in paraffin, for which the bayberry wax is substituted. In its preparation, as much wax should be applied as is necessary to obtain a thick sheet. In producing pseudoarthrosis where it is necessary to denude the bony surface in order to prevent excessive hemorrhage into the joint, the warm, sterile bayberry wax may be conveniently spread over the bleeding surface and thoroughly worked in, after which the sheet silk and bayberry wax may be interposed, but need not necessarily be anchored down with sutures; in the case of a knee-joint a few sutures may be an advantage, and if the technic is carefully followed, a joint free from hemorrhage may be had. Bayberry wax has a higher melting-point than paraffin, and is quite brittle; therefore the sheet silk and wax should be immersed in warm, sterile water, so as to make it more pliable. The silk is used as a vehicle only for the wax; whether the wax has an antiseptic property it is difficult to say, but the results obtained seem to warrant its use in cases where one wishes to do a radical bone operation.

CLINICAL DEPARTMENT

XLI.

THE DIAGNOSIS OF TRAUMATIC PERIOSTITIS OF THE LUMBOSACRAL SPINE.

BY CLARENCE E. COON, SYRACUSE, N. Y.

During the past few years a lot of attention has been given to the diagnosis of lesions of the spine and particularly the lower lumbar and sacral regions. As a result of this study and demonstration it has become an accepted fact that most backaches present some definite lesion, and that the diagnoses of railway spine, neuritis, etc., are less often used. If in this brief paper, we confine our observations to the lower lumbar and sacral areas and also take into consideration only those backaches due to trauma, we will still find many cases in which a positive diagnosis of a definite lesion is not always easy. Many of these patients will present the characteristic symptoms of sacroiliac strain or displacement; in such, the diagnosis is not often difficult. Others will give evidence of a fracture, and the X-ray will show a fracture of a transverse process of the fourth or fifth lumbar or a fracture involving the body of the vertebra or an articular process, or a fracture into the sacroiliac articulation. Because of the severity of injury, in this class of cases, the symptoms presented will often be confusing and accurate diagnosis is not possible without the X-ray.

Dislocation of the fifth lumbar vertebra or spondylolisthesis, is, I believe, not as common as fractures in this region.

Abnormalities of the fifth lumbar vertebra and sacrum must not be overlooked, while of themselves they are not the primary cause of backache, yet in the presence of an injury, such abnormalities may exert a powerful influence. Dislocation of the articular processes of the fourth and fifth lumbar and of fifth lumbar and sacrum may occur.

If we now for the present exclude also these cases in which there is a clearly demonstrable lesion we still have many backaches of the lumbosacral region which occur after an injury, and are often very persistent, and it is this class of cases in which it is often so very difficult to make a diagnosis between something and nothing. To know whether the patient is a malingerer or not, and particularly is this so when called upon to testify as a witness in court in a negligence action.

During the past year I have been called upon to examine fifteen cases, in which any of the lesions cited above could not be demonstrated.

In a general way all of these patients complained of pain in the lumbosacral region, all had muscular spasm, preventing free flexion of the lumbar spine. Some had localized paralysis, anesthesia or hyperesthesia; in none was it possible to demonstrate any abnormality of the bone, either congenital or as the result of trauma.

In this series of cases in which the diagnosis seems fairly accurate, examination was requested not less than one month after the injury. Twelve of the series were examined during the first year, and three after one year. In all cases a careful X-ray study was made in addition to the clinical examination.

Case I.—E. F., Man, aged thirty-five. Fell from a scaffol a distance of 12 feet six weeks previous to examination. Injured right arm and back. In hospital four weeks unable to move without assistance on account of pain in back. At present all movements lumbar spine extremely limited, muscular spasm, hyperesthesia, more marked in left lower extremity, patellar reflexes exaggerated. X-ray shows haziness with indistinct bone outlines in region of fifth lumbar. Same characteristics shown on plates at re-examination several days later.

Case II.—Mrs. D. S. Patient is quite stout. Injured seven months previous getting off trolley car while in motion. Fell and rolled down embankment. Injury to kidneys, rectum and back. At present pain in lower back. All movements of back sharply limited. Unusual amount of lumbar lordosis for a fleshy patient. Anesthesia of outer side of left thigh.

X-ray, very indistinct and irregular outlines of the fifth lumbar vertebra and top of sacrum. Some evidences of callus formation.

CASE III.—Mr. H. C. B. Injured fourteen weeks previous by being caught and doubled up between two freight cars. In hospital four weeks and unable to work since injury on account of pain in small of back. Tender on pressure in fifth lumbar region. No anesthesia or hyperesthesia. All movements of lower lumbar spine restricted.

X-ray outlines not clear of fifth lumbar and top of sacrum.

CASE IV.—Mr. M. W. Injured nine and one-half months previous by falling from scaffold distance about 23 feet. Landed in sitting position. Unable to move either lower extremity for five weeks. Has not good control of muscles of right lower extremity at present time. The left extremity seems all right. No sensory disturbance except pain in back. Stands with absence of lumbar lordosis. Attempts to produce normal curve causes severe pain. All movements of back limited.

X-ray shows marked irregularity of outline of right side of fifth lumbar and upper part of sacroiliac articulation with a possible fracture of transverse process. Left side of vertebra cloudy and indistinct.

CASE V.—Mr. C. A. H. Injured two months previous by being hit in the back by a trunk which fell from a truck. Patient was doubled up as he fell. Has a lot of pain in his back and thighs. Movements of lumbar spine limited in all directions. Patient is rather stout and has more than ordinary amount of lumbar lordosis, tender on pressure in fifth lumbar region.

X-ray examinations made on four different occasions during one month in an effort to make a positive diagnosis. Each time exposure made at different angle, stereoscopic, etc. The outlines of the fourth and fifth lumbar were not clearly defined and regular.

CASE VI. Mr. A. W. Fell into a furnace hole nine months and three weeks previous, striking on his back and side. Passed blood and pus from urine for a time. Complains now of pain in back and rectum. Tender on pressure fifth lumbar. Back flexion about half normal.

X-ray fuzzy appearance, transverse process, left side fifth lumbar.

CASE VII.—Mr. E. E. L. Injured three and one-half months previous. Fell about 14 feet and injured back. Unable to use right lower extremity for about four weeks. Complains of prickling in both feet. Patellar reflexes very much exaggerated. Patient stands with decided list to left. Very tender on pressure over fifth lumbar. Movements of back very limited. Right lateral flexion entirely absent.

X-ray and tilting seemed to indicate fracture of left side of body of fifth lumbar. Outlines very indistinct.

Case VIII.—Mr. H. M. P. Caught in an elevator one month previous. For about ten days he was unable to turn over in bed on account of severe pain across back and hips. Three days after accident both lower extremities felt prickly and numb. During the first week any attempt to move the legs would cause spasm and pain in muscles of back and hips. At present no impaired sensation or motion in legs. Patient stands with list to right, tender on pressure in lower lumbar region. Forward and right lateral flexion of the back fairly free. Left lateral very limited. Repeated X-ray examination. Unable to show fracture. Right side of fourth and fifth lumbar very indistinct. Left less so.

These brief reports of cases are fairly typical of the others of the series observed. Routine examination, as to posture, movements, impaired nerves, etc., was made in each case. Abnormalities only are noted. A majority when examined showed little or no deviation of the spine. Spasm of the hamstrings not marked and usually about equal on each side.

The symptoms common to all are entirely subjective and consist of pain, tenderness and limited motion. No constant objective symptoms could be found except the evidence offered by the X-ray plates and these seemed to present the same general characteristics in each of the series, viz., the cloudy, fuzzy appearance of the bones in the painful area, and this was interpreted to mean that because of the injury the ligaments and periosteum were injured, the resulting inflammation aggravated by more or less constant use of the part had produced a condition allied to callus formation and that there was a considerable deposit of lime salts in the tissues immediately surrounding the bone, that because of the irregular distribution of this deposit, being more dense near the bone the X-ray outlines of the bone were invariably obscured and it was impossible with repeated examinations to get a clear, well defined shadow of the bones of the injured area, at the same time and on the same plate the bones above and below the painful area produced a clear and well defined shadow. This cloudy appearance could not be shown in cases examined less than one month after the injury, which seems to agree with the X-ray appearance of callus formation in bone injuries elsewhere. Much might be written of the frequency of injuries to this part of the spine, as to its causes, etc., but if we have in mind the anatomy of the part and know something of the direction of the force applied at the time of injury it will be readily seen that this part of the spine is very liable to be injured. And in this series of cases the force which produced the injury was not sufficient to cause a fracture or dislocation but had produced a stretching or tearing of surrounding ligaments and periosteum and in the process of repair, nature had deposited some lime salts.

This calcareous deposit cannot be demonstrated until about one month after the injury but when present helps to explain why many of these backaches are so persistent.

Then with a patient complaining of pain, tenderness and inability to move freely, with a history of previous injury. And a series of X-ray plates showing more than normal obstruction to passage of light rays. I think we are justified in making the diagnosis of traumatic periostitis.

Once a correct diagnosis is made the treatment is indicated. The usual treatment accorded railway spine or neuritis does not suffice.

XLII.

SPONTANEOUS LUXATION AT THE HIP-JOINT AS A SEQUEL OF TYPHOID FEVER.

CHARLES M. JACOBS, M. D., CHICAGO.

With all deference to the many prior excellent contributions to the literature of sequelar joint infection in typhoid, I take the liberty of presenting to this society some observations on this topic with special reference to spontaneous luxation at the hip-joint.

Our knowledge of the pathologic process of typho-arthritis is still more or less theoretic, because the complication is not fatal *per se*.

Our ability to imitate by experimental methods the pathologic lesions and symptomatic manifestations of specific diseases always has been of great advantage in scientific medicine, and through these experiments we have been able to study the pathologic changes under laboratory conditions. While some definite knowledge of typho-arthritis has been gained through experimental work on rabbits, it has been impossible to produce in the animals infected with typhoid, characteristic lesions analogous to those found in the human subject. Recent work has shown that the monkey is susceptible to a number of diseases which affect man, but which are transmissible with difficulty, if at all, to rabbits and guinea-pigs. The use of the monkey, therefore, for the experimental production of typho-arthritis may give us a clearer conception of the pathologic process of this condition and the manner in which luxation occurs.

Even prior to the time of Louis, who, in 1829, first gave the name typhoid to the fever, writers recorded observations of spontaneous luxation at the hip-joint as a sequel of what apparently was typhoid fever.

Hippocrates and Galen recognized the possibility of spontaneous luxation and Petit, Desault and Bichat advanced theories as to the nature of their mechanism. A more definite description of post-typhoid luxation appeared in the works of Lorinser (1853) and Helwig and Bauer (1856) Seitz (1864) and others.

Despite the splendid work of the above-mentioned modern writers, it was left to Keen, in 1898, to give the most complete discussion of the subject which had appeared up to that time. Keen's views have been accepted by later American and English writers who have added nothing of their own.

The frequency of spontaneous luxation following typhoid undoubtedly is greater than the published cases would indicate, because many are never recorded.

I have not attempted to collect all published cases since Keen, in 1898, tabulated all the then known cases, forty in number, but in the intervening fifteen years, I have collected a sufficient number to prove that spontaneous luxation is not rare. It is, however, relatively infrequent, in view of the frequency of typhoid.

The contributing causes of typho-arthritis are a moot point. That it may be due to the growth of the Bacillus typhosus in excessive number within the joint with liberation of endotoxins is not denied, but in many cases according to Goldthwaite it seems probable that the arthritis is the result of a toxin produced elsewhere in the body, and reaching the joint *via* the blood. In view of our knowledge of the bacteriology of the blood in typhoid, the latter theory does not seem plausible, though I must admit that it has not been refuted by any experimental study. In reference to the first theory there is no record of any attempt to provoke a typho-arthritis by inoculations into the joints of animals, of isolated pure cultures from the exudate of a typho-arthritis in man.

According to Florange typhoid bacilli are constantly in the bone marrow and may invade the joint as an extension from the osseous lesion. Even admitting this possibility, its demonstration might be extremely difficult.

Hübner found the typhoid bacillus in the head of the femur and the surrounding granulation tissue, which he removed from a patient with spontaneous luxation of the hip following typhoid.

Bacteriologic examination of the arthritic effusion has shown that the primary infecting agent is the Koch-Eberth bacillus. This has been found in pure culture. Grancher (*Bull. Med.*, 1892, VI) obtained the typhoid bacillus from a teno-synovitis following typhoid. Hunkin aspirated 50 c.c. of reddish fluid from the hip-joint of a boy, aged twelve years, convalescing from typhoid, and obtained the typhoid bacillus in pure culture.

The negative results given in the literature do not necessarily overthrow typho-bacillary etiology; the finding in some cases of sterile fluid in the joint is explained by the fact that in the liberation of the endotoxins the bacteria disintegrate.

Experiments on rabbits have shown that the Bacillus typhosus may be present early and may be recovered in pure culture from the exudate of the knee-joint. After a period of six to sixteen days, however, the exudate is sterile.

The articular effusion may be serous, serofibrinous or, less often, purulent. Kummer cites twenty-nine cases of spontaneous dislocation of the hip due to acute infectious diseases in which the arthritis was recognized before the occurrence of the luxation. In twenty-two cases the effusion was either serous or serofibrinous, and in three it was purulent.

It is my opinion that in man, the bacilli rarely mass together in such numbers as to become pus producers which may be clinically demonstrated. Streptocococci or staphylocci, either alone or combined, may be present within the joint of a patient convalescing from typhoid fever and produce a purulent process, but they probably are not to be regarded as essential factors in the production of the lesion. Dmochowski and Janowski have pointed out that when typhoid bacilli were found in the pus, it was unlikely that other organisms preexisted in the joint.

The few cases reported showing the pyogenic nature of the typhoid bacillus as occurring in the joints of man cannot be conspicuously offered as evidence, although they are worthy of consideration.

Martin and Robertson and Johnson each describes a case in which a small amount of pus was aspirated from the wrist-joint of an adult, and the typhoid bacilli were obtained in pure culture.

Graff reports a case of spontaneous dislocation of the hip of a girl following typhoid fever, in whom, eighteen months later, an abscess made its appearance in the adductor region of the thigh and culture experiments demonstrated the typhoid bacillus. It is questionable, in this case, whether or not the pus was derived from the joint.

Animal experimentation has conclusively demonstrated the pyogenic nature of the typhoid bacillus in joints.

Arcoles produced suppurative arthritis in five young rabbits by injecting broth cultures of typhoid bacillus into the joints or by injuring joints after injecting the bacilli into a vein. The exudate in the joints contained typhoid bacilli in pure culture.

Colzi (Florange, *These de paris*, p. 93, 1903) in a way followed the experiment of Arcoles by injecting typhoid bacilli into the vein of the ear of a rabbit and then dislocated the hip. The animal died at the expiration of forty-eight days, greatly emaciated, but otherwise without symptoms. The dislocated joint contained a large amount of pus with a few typhoid bacilli. In a second rabbit, he injected into a vein, bacilli from the spleen of a child dead from typhoid fever and, immediately following the injection, fractured the femur. The rabbit died ten days later. The knee-joint was found to contain a collection resembling pus together with the presence of typhoid bacilli; at the point of fracture an abscess was found.

Ellis produced experimentally a seropurulent or purulent exudate in twelve rabbits. In five of the rabbits the typhoid bacilli were injected into the veins at different periods previous to injury of the knee-joints; in seven the injections were made directly into the joints. Inoculation from the joint contents were made in eleven of the cases, and the typhoid bacillus was recovered in pure culture in five, after a period of one, four, eight, ten, and eleven days respectively.

Many theories have been advanced to explain the mechanism of spontaneous luxation following infectious diseases, only to fail because of insufficient evidence. The presence of large effusion in the joint, which distends the capsule, weakens and stretches the support of the joint forcing it apart, reflects the opinion of authors of wide experience.

Hippocrates was the first to deduce that it was the result of a hydrarthrosis. Galen enlarged and commented on this theory. Petit, in 1722 and 1741, unfolded the Hippocratic theory which bears his name. Desault (1781) and Bichat opposed the hypothesis of Petit in favor of one of their own, viz., that the material causes of these luxations is an engorgement in the articular cartilage which affected and destroyed their organization.

It was Parise who first definitely accepted the hypothesis of Petit by proving experimentally that if 40 to 50 grams of water was injected into the hip-joint of an adult cadaver, the femur would assume the position of flexion, abduction, and outward rotation, and that the greater trochanter would be pushed about 1 1/2 to 2 cm. away from the acetabulum. The filling of the joint cavity with the liquid puts the ligaments on the stretch and nullifies the effect of atmospheric pressure. The femoral head is no longer in the bottom of the acetabulum, but on a level with the rim, and the least movement, whether the limb is in abduction or adduction, causes luxation. Roser was of the opinion that luxation begins gradually as the result of destruction of the acetabulum, and that the luxation was always a posterior one.

According to Huter, spontaneous luxation is not due to a serous exudate, but to pus, analogous to a tuberculous coxitis resulting in a widening of the acetabulum due to destruction of the cartilage of the rim. Destruction also takes place in the head of the femur. He contends that the pus is absorbed, thus explaining the reason for its absence postmortem. This theory is contested by Ardisson, inasmuch as typhoid fever causes articular effusion of a serohematic character which rarely passes into suppuration.

Verneuil believed that the periarticular muscles play a most important rôle in the causation of spontaneous dislocation. Some are paretic, others are contracted. In the early stage of the arthritis the muscles put the joint at rest to avoid pain. This muscular condition does not persist for any length of time, but modifies itself if the arthritis is prolonged. The extensors become paretic and the flexors contract, and finally are the only muscles acting. This localization of the paresis in the extensor group is almost constant. Pozzi gives an explanation for this, supposed to be based on a law of pathologic anatomy, viz., that the degeneration selectively affects the muscles in proportion to their activity.

Graff claims that the articular effusion in the joint is either serous or serofibrinous, and causes no distention of the capsule, but an inflammatory softening of the rim of the acetabulum, which gradually disappears under the pressure of the femoral head. With strange inconsistency, he denies that any actual destructive process takes place.

Ardisson states that hydrarthrosis cannot by itself cause a dislocation of the head of the femur. It will pull the head up and away from the bottom of the acetabulum, and on a level with the rim thereby preparing the way for the dislocation by distending and relaxing the ligaments. The joint is painful, and the muscles therefore place the limb in the most comfortable position, which is flexion. The extensors soon become paretic and the antagonistic muscles, being unopposed, contract, causing adduction. The position of the femoral head on the posterior border of the acetabulum results in an articular migration upward and backward with a true dislocation.

Stimson states that spontaneous luxation is preceded for a long period of time by the maintenance of the limb in the position of flexion, adduction, and inward rotation, favoring the occurrence of such a deformity, and that the pain of the arthritis stimulates the muscles to contract. The contraction of the muscles, in turn, causes the luxation and the "arthritis favors it, not by overstretching the ligaments, but by supplying an amount of liquid that removes the obstacle created by atmospheric pressure."

Ellis has attacked this problem afresh from an experimental point of view. In the twelve rabbits previously mentioned, in which suppurative arthritis of the knee-joint was induced, certain destructive changes took place. In three animals there was extensive necrosis of interarticular ligaments; in one, erosion of the semilunar cartilages; in three, there was destruction of the overlying soft parts and erosion of the articular surface of bone, the tibia being affected in each instance. Hyaline degeneration of the muscles surrounding the joint occurred in three animals. He concludes that these experiments may throw some light on the subject, in that they clearly demonstrate that the typhoid bacillus produce certain destructive changes in the joint, attacking synovial membrane, ligaments, cartilage, muscles, etc., thus showing that luxation would be favored by such pathologic changes. To what extent these observations on animals may be applied to the human typhoid joint, Ellis does not say, but he considers all the destructive changes enumerated as at least possible in the typhoid arthritis occurring in the human subject. Of the pathologic changes in the hip-joint existing in the old spontaneous luxation, but little is known from direct examination. The opportunities for studying such changes are rare.

Rawden excised the head of the femur for a dislocation following typhoid, and found it normal. The cartilage, too, was normal except for a slight absorption at the periphery. Hubner reports the case of a girl, fourteen years old, who had typhoid fever and upon whom he operated five months later for dislocation of the hip. He found the acetabulum well formed and covered with a small amount of granulation tissue. The head of the femur was embedded in granulation tissue which was free and situated above and behind the acetabulum. Quite different from the above is the case cited by Kummer. A child of ten and one-half years of age, with a recent spontaneous luxation following typhoid fever, was operated upon and the ligamentum teres was found to be elongated, the posterior portion of the capsule greatly thickened, and the acetabulum filled with fibrous gristly tissue. Graff operated upon a double spontaneous luxation of the hip, following typhoid fever. The right was an ischiatic, while the left was an iliac dislocation. The acetabula were recognized with difficulty because they were filled with hard, fibrous masses which were impossible to cut with a knife. The head of the right femur was somewhat deformed; the head of the left femur showed changes similar to arthritis deformans. It may not be out of place to state that Rothschild (*Berlin klin. Wochenschr.*, XLVII, 1910) reports two cases in which typic pathologic changes of arthritis deformans developed after several years in joints previously affected during typhoid fever.

Graff claims that the pathologic changes in spontaneous luxation are probably the same as in old traumatic luxations, provided there have been no previous fractures. The characteristic changes are a shallowness of the acetabulum which is filled with a hard, compact, fibrous tissue. The upper rim of the acetabulum increases in height; the displaced femoral head shows changes varying in extent and consisting either of a slight absorption of the cartilage, or an increase of cartilage in places, with some change in the shape of the femoral head, but never showing great destruction.

Keen's classification of typho-arthritis, which he divides into rheumatic, arthritic proper, and pyemic forms, thus making three distinct types of one condition, is rather misleading and confusing.

There is no evidence that joint affections associated with typhoid fever are due to articular rheumatism, but are the result of the specific action of typhoid bacilli. The "pyemic" form, though rare in typhoid, may follow an acute infection, and runs the usual course.

Typho-arthritis, in its clinical course, presents itself under two different aspects. 1. Arthritic manifestations. 2. Vicious position with spontaneous luxation.

The arthritic manifestations resemble at their onset any other acute joint inflammation. Pain in the hip, which radiates down the thigh, occurs during the height of the fever, less often during the period of defervescence; swelling at the joint is at first slight and at this time the fever gradually increases. The inflammation may slowly subside and the joint completely recover. Again the arthritis may persist, and pain and swelling gradually increase. The limb now assumes the vicious position, flexion, adduction, and inward rotation, and the slightest movement favors the slipping of the femoral head out of the acetabulum. The luxation is usually observed during convalescence. Great relief from pain follows the luxation at the joint, because the tension of the muscles is overcome.

The luxation is now similar to that found in traumatic dislocations. The attitude of the limb is still one of flexion, adduction, and inward rotation, but unlike traumatic luxation rupture of the capsule seldom or never occurs.

Treatment.—As spontaneous luxation is secondary to a pre-existing arthritis, the importance of prevention at this stage is to be emphasized if the deformity is to be prevented. The attending physician should bear in mind the possibility of the occurrence of this complication and be on his guard when the pain is complained of in the hip and the limb assumes an abnormal position.

Extension by weight and pulley relieves the pain and assists in overcoming the faulty position, but it is not in itself sufficient to entirely prevent luxation. The effusion plays so important a rôle in the production of luxation, that aspiration of the joint is essential. Aspiration aids in preventing luxation and relieves pain. The case of Hunkin, previously cited, bears out the truth of this assertion as no luxation occurred after aspirating.

If luxation has occurred and effusion can be detected in the joint, the necessity for aspiration is indicated.

The management of early luxations should be similar to that in congenital luxations. Bloodless reduction by the method of Lorenz, or a modified method, with the limb held in the Lorenz position by a plaster cast will succeed in most cases, but the possibility of recurrence of the luxation is to be remembered. Reduction, however, should not be made until convalescence has been well established.

The effects of too early reduction is well illustrated by the following case:

Toby L., aged five years, entered Mercy Hospital, Dec. 5, 1905, ill with typhoid fever. On December 18 (the seventeenth day of the disease) she first complained of a slight pain in the right thigh. Average temperature, 103 2/5, pulse 116. Nine days later the pain was very acute, with temperature 100; pulse 102. January 4, 1906 (thirty-fourth day of the disease) the limb was held in a position of marked flexion and adduction, and swelling could be detected at the hip. Average temperature and pulse 100. Two days later (thirty-sixth day of the disease) the upper portion of the thigh was badly swollen and the patient unable to extend the limb. From this time on she suffered little or no pain, except in attempting to move or in being moved. Temperature and pulse normal.

The patient was then transferred from the medical to the surgical service, and a skiagraph of the hip-joint made. This showed the head of the femur displaced upward, with perhaps some erosion of the femoral neck. At this time I was asked to look at the case by Dr. Wm. E. Morgan, the staff surgeon, and upon examination I found the upper portion of the thigh swollen, the greater trochanterof the femur about two finger breadths above Nélaton's line, and the limb flexed and adducted. The day following the patient was anesthetized and I replaced the femoral head by the Lorenz method, not, however, without some anxiety, for during the course of my manipulations of the joint a sudden, tearing, grating sound was heard, which led me to fear I had fractured the femoral neck. My fears proved groundless, as I probably had merely broken up some firm adhesions. The limb was then placed in a position of extension and slight abduction, and a plaster-of-Paris spica applied.

Within twenty-four hours following the replacement the temperature and pulse rose to 104 and 172, respectively, remaining high for some days, then gradually subsiding to 101 and 134, and so remaining for several weeks.

An X-ray picture taken a few days after the replacement showed the head of the femur in the acetabulum. This was the last I saw of the case. Later I learned that, owing to the carelessness of the nurses in attendance, the cast became wet

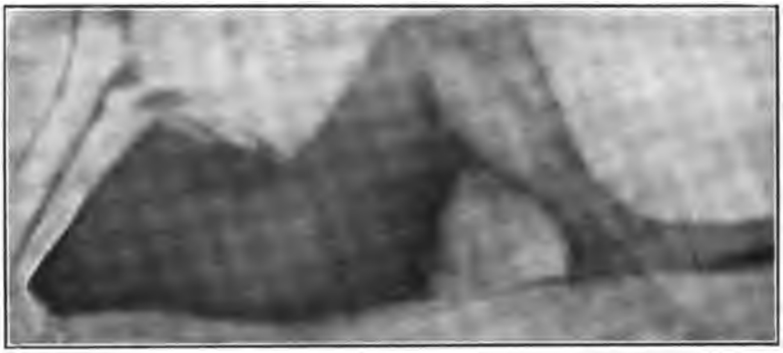

FIG. 1.—CASE I. Acute stage of typho-arthritis, showing the vicious position of the limb. (Note the enlarged upper part of the thigh, the result of effusion in the hip-joint.)

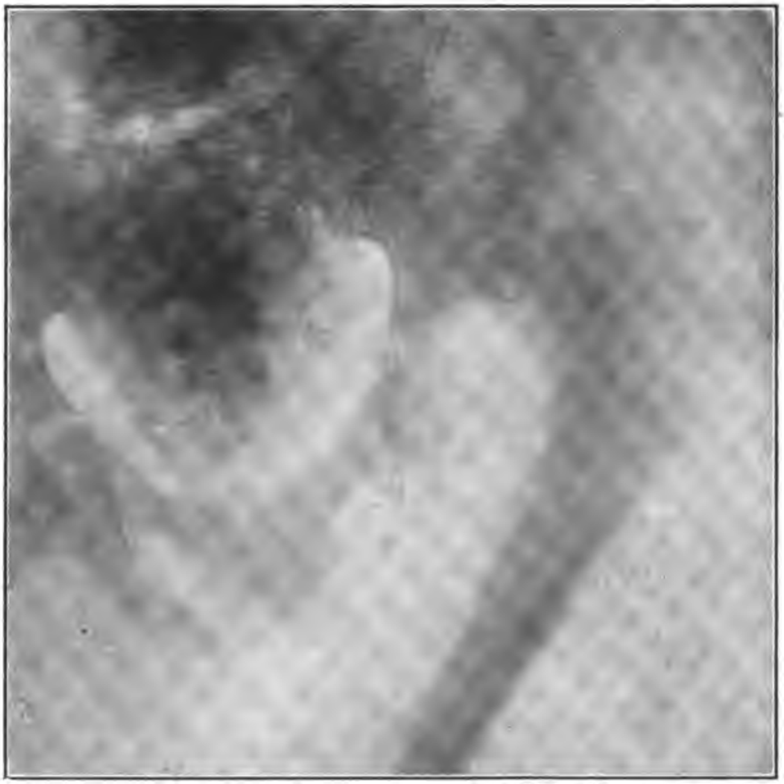

FIG. 2.—CASE I. Spontaneous luxation at the hip-joint. (Note the erosion of the femoral neck.)

and unclean from urination, irritating the skin beneath, so that it was necessary to remove it. Instead of applying a new cast, a splint without traction was used, and a recurrence of the luxation resulted.

The length of time that may elapse between the occurrence of the luxation and the replacement varies. Brandes claims that after one and one-half years reposition is possible by the bloodless method, but that luxation will reoccur. This of course is due to the pathologic changes that are more or less permanently established. The weight of evidence seems to be in

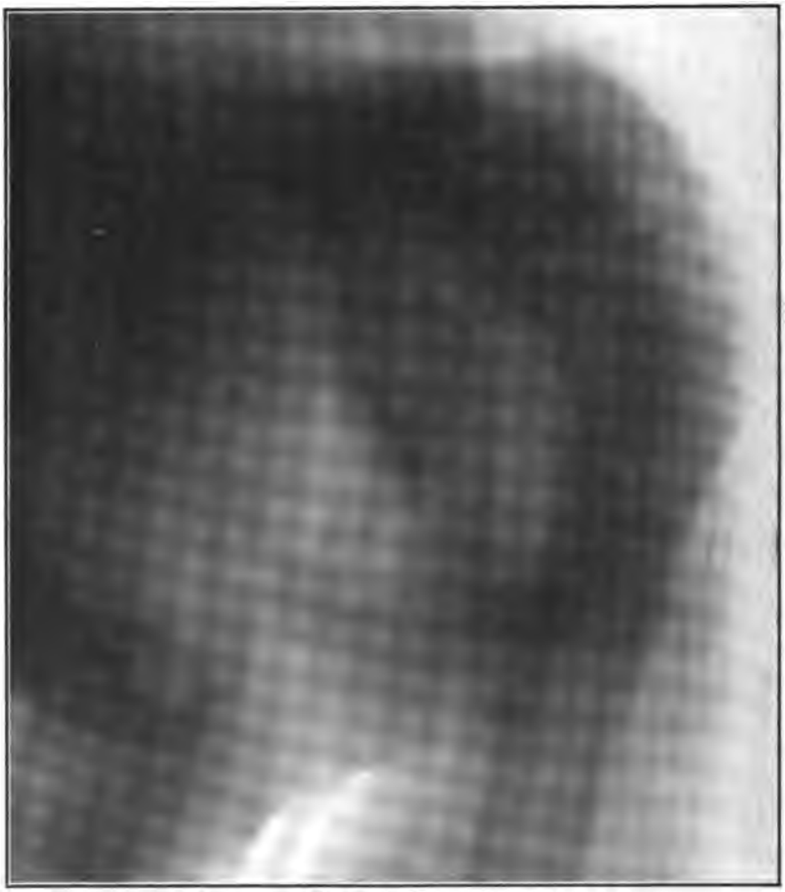

FIG. 1.—CASE II.—Spontaneous luxation at the hip-joint. (Note the erosion in both the femoral head and neck.)

favor of a period varying from four to six months, after which time operation becomes necessary.

CASE II.—Lee. T., aged five years. Taken ill with typhoid fever the end of September, 1906. Was sick four or five weeks. It was at the end of this period that the right limb was first noticed to be short and deformed. It became necessary to use crutches in walking. March 15, 1907.

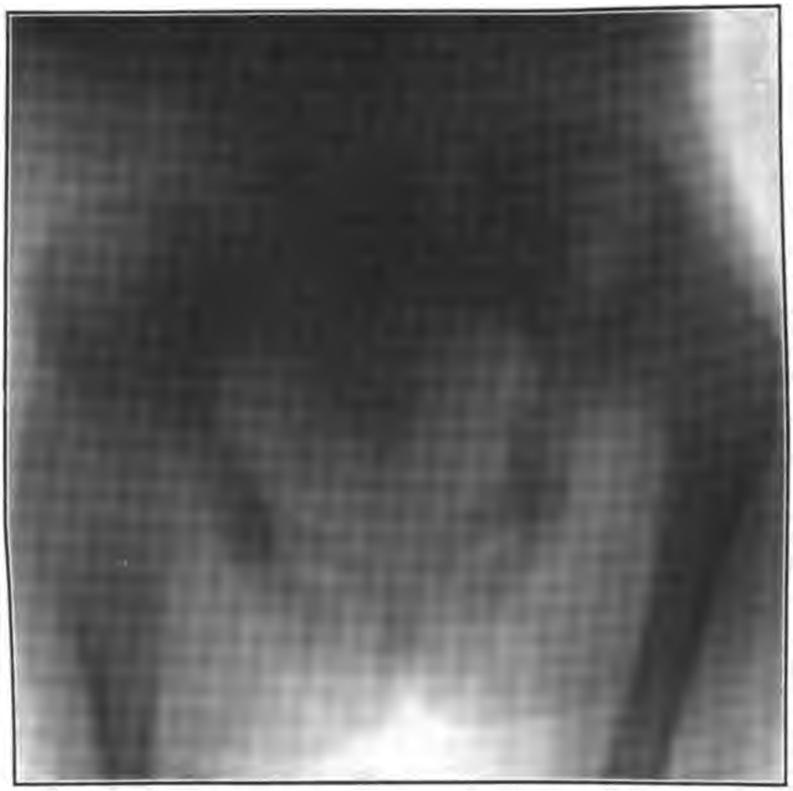

FIG. 1.—CASE III. Spontaneous luxation at the hip-joint.

Examination.—Right limb is held in the position of flexion, adduction, and inward rotation. The greater trochanter is above Nélaton's line; the head of the femur can be felt under the gluteal muscles, and measurement shows the limb to be 1 1/4 inches shorter than the left one.

Diagnosis.—Spontaneous luxation following typhoid fever.

March 29, 1907. Ether given. The femoral head replaced in the acetabulum by the Lorenz method. Plaster cast applied with the limb in position of extension and abduction.

June 7, 1907. Cast removed. Femoral head out of the acetabulum. X-ray taken.

The above case illustrates that in a luxation of five months' duration reposition by the bloodless method is possible. That the luxation reoccurred was due, in my opinion, not to pathologic changes, but to faulty technic in that the limb was not placed in the Lorenz position.

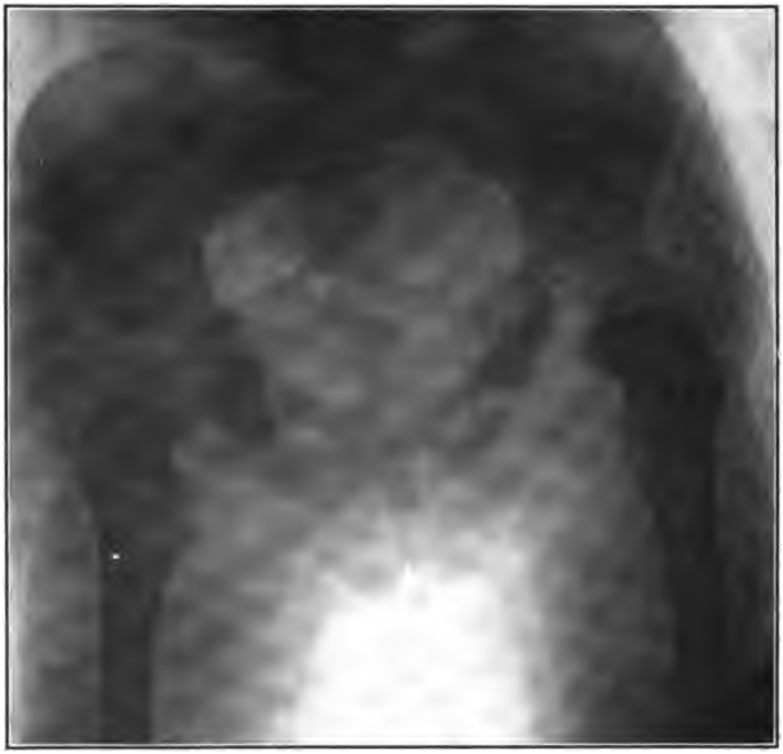

FIG. 2.—CASE III. After replacement.

That the treatment of spontaneous luxation as a sequel of typhoid fever may be successful is shown by Case III. First, because of early procedure, and second, because of proper technic.

CASE III.—Flora F., aged three and one-half years. Taken ill with typhoid fever about January 10, 1911. Two weeks later, it was noticed that the position assumed by the child was that of lying on her right side, with the left limb flexed and adducted. The left hip, at this time, was swollen and painful. No other complications occurred and convalescence was established at the usual time. Because of the deformity the child has not walked.

April 1, 1911. Examination. Lies on right side with left limb held in marked flexion and adduction. The greater trochanter is about 3/4 inch above Nélaton's line and the femoral head can be felt under the gluteal muscles. X-ray picture shows the femoral head out of the acetabulum.

April 4, 1911. Ether given. The femoral head was easily replaced in the acetabulum by the Lorenz method. The limb was then held in the position of right-angled abduction with marked outward rotation and a plaster cast applied.

September, 1911. Cast removed. X-ray picture shows femoral head in the acetabulum.

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EDITORIAL.

One cannot run his eye over the record of the social uplift efforts being put forth in these days or merely recount the names of the various societies, from the Better Babies Bureau up, without pausing occasionally to wonder what would happen if there were none of these societies and how long it would be before the entire social fabric would be disrupted by the ravages of disease, both social and physical, and reduced to a condition of economic dependence through the failure of the youth to maintain the highest degree of efficiency as measured by present-day efficiency tests. The last part of the Sermon on the Mount, from the twenty-fifth verse of the sixth chapter of Matthew on, seems like contradictory, not merely antiquated, doctrine in these days.

Now comes the American Posture League preaching the gospel of physical efficiency through attention to posture in standing, sitting, and walking, whether for rest or recreation, or when at work; through attention to the clothing of children and adults, seeing to it that the public is educated to know what is best and where it may be had; through scientific study of the problems of school and factory hygiene to secure the greatest efficiency by instruction in the ways of overcoming the physical hardships incident to the special conditions and environment under which the world's work is being done; by lessening the wear and tear and fatigue of travel, both local and long distance, through the application of sensible suggestions to the seating of travelers using the transportation facilities of the country, and in many other ways contributing to the health and therefore enhancing the potentiality of the race for effective service. The day of "taking no thought for your life, what ye shall eat, or what ye shall drink; nor yet for your body, what ye shall put on" has gone by, and has given place to an absolutely opposite doctrine, one which concerns itself with every conceivable detail of our personal life.

The following outline of the purposes of the League will be of interest.

Official announcement was made on April 2, of the incorporation at Albany of the American Posture League, a national body formed to improve human health and efficiency, through interesting the public in correct physical posture and the improvement of conditions affecting it.

The new organization is concerned with the sitting and standing position of children in schools and of adults in shops, offices, factories and elsewhere. It hopes to effect a more general use of scientific and healthful principles in seating accommodations for working purposes and for public audience rooms and vehicles.

"A child cannot achieve proper chest development," is its authoritative statement, "while the shape of his school seat and of his coat force him for many hours each day into faulty attitudes. Thousands of children who carry heavy loads of school books are forced into distortions of posture that in all but the most robust must have a serious effect on health and development. Round shoulders are to be expected in a child whose clothing is supported without proper regard for the anatomy and mechanics of the shoulder. The fatigue of the factory operative comes not more from running the factory machinery than from running the bodily machinery—heart, lungs and digestive organs—at a mechanical disadvantage, through ill-adapted chairs, stools and work benches. Measures to relieve tuberculosis, anemia and malnutrition are all placed at a disadvantage by the constant moulding influence exerted on habits of posture by much that is bad in furniture and clothing.

No organized attempt to standardize these various conditions has ever been made before. Individual orthopedic surgeons, and in a few instances special commissions, have attempted improvements, but the skill and judgment of the experts have never been combined in united effort. A great field of hygiene and preventive medicine is ready for cultivation, and the American Posture League is peculiarly fitted to enter it, since it includes in its membership leading orthopedic surgeons, physical trainers and educators who have specialized on these subjects for years.

The League hopes by systematic education to establish a demand for healthful standards in what may be termed posture engineering. It is definitely organized to do technical work along these lines. For example, it is already assisting with expert advice the engineers of the Brooklyn Rapid Transit Company, the seats of whose new subway cars are being constructed in accordance with the League's specifications. It is in touch with several large organizations of workers engaged in the standing occupations—such as motormen and shopgirls—and purposes issuing official bulletins for their benefit, illustrating the correct standing postures, both for work and rest.

Bulletins taking up the various phases of school and factory hygiene that affect posture, and making constructive suggestions, will also be issued to school superintendents and other officials throughout the country, as well as to heads of private schools and colleges and to efficiency managers. Lantern slides will be prepared and circulated to supplement a country-wide campaign of education by means of bulletins.

The League owes its inception to its President, Miss Jessie H. Bancroft, Assistant Director of Physical Training in the public schools of New York city. On its board of directors are Dr. Frederick R. Green, of Chicago, Secretary of the Council on Health and Public Instruction of the American Medical Association; Dr. Joel E. Goldthwait, of Boston, ex-President of the American Orthopedic Association; Dr. R. Tait McKenzie, the well-known sculptor, who is Director of the Physical Education Department of the University of Pennsylvania; Dr. Henry Ling Taylor, professor of orthopedic surgery in the New York Postgraduate Medical School; Dr. Thomas A. Storey, professor of hygiene and physical instruction in the College of the City of New York; Dr. S. Josephine Baker, Director of the Department of Child Hygiene, New York

City Board of Health; Dr. Eliza M. Mosher, of Brooklyn; Dr. Eleonora Everhard, of Dayton, Ohio; Dr. William H. Burnham, of Worcester, Mass., and Dr. E. G. Brackett, of Boston.

The board of electors, by whom the directors are chosen, is headed by Philander P. Claxton, United States Commissioner of Education, and has among its members William H. Maxwell, Superintendent of Schools, New York City; Professor Irving Fisher, of Yale; Chairman of the Committee of One Hundred to Promote Public Health; Dr. Robert L. Dickinson, of Brooklyn; Dr. Fletcher B. Dresslar, specialist in school hygiene and school sanitation United States Bureau of Education and President-elect of George Peabody College for Teachers, Nashville; Miss Amy Morris Homans, Director of Physical Education and Hygiene, Wellesley College; Dr. William Webber Ford, Johns Hopkins Medical School, of Baltimore; Dr. Melville Dewey, of New York; Dr. J. George Adami, of Montreal; and Dr. Ernest B. Hoag, of Los Angeles. There is also an advisory board of prominent men and women.

To meet the expenses of its initial bulletins, technical photography, etc., the League is dependent upon membership fees and hopes by this means to raise $5000 at once. Life memberships are $500 or more; one becomes a patron on payment of $250, an annual donor for $100 annnually, an annual member for $50 annually, a contributing member for $25, an associate member for $10 and an active member for $1 annually.

The acting Treasurer is Cornelius S. Loder, 30 Church Street.

MALFORMATIONS, MENDELISM AND MUTATION.

For those interested in skeletal conditions the most valuable general address at the late International Medical Congress in London, was that delivered by Professor Bateson upon Heredity. In that address Bateson afforded a review of recent work upon the inheritance of morbid states, and that review included an enumeration of some widespread skeletal malformations. He there described the essence of the Mendelian principle so simply that we cannot do better than reproduce his statement in his own words.

"It is, first, that in great measure the properties of organisms are due to the presence of distinct, detachable elements, separately transmitted in heredity; and secondly; that the parent cannot pass on to offspring an element—and consequently the corresponding property—which it does not itself possess. The determination or recognition of these elements by analytical breeding is one of the main objects of present-day genetic research. Each germ cell, ovum or sperm, may contain or be devoid of any of these elements; and since all ordinary animals and plants arise by the union of two germ cells in fertilization, each resulting individual may obviously receive in fertilization similar elements from both parents or from neither. In these cases the offspring is 'pure'-bred for the presence of the character in question, or for its absence. But it may be formed by the union of dissimilar germs, one containing the element, the other devoid of it, and in this case we call the individual cross-bred, or heterozygous in that respect.

"A population thus consists of three classes of individuals, those pure for the presence, having received two doses of an element; those pure for the absence of the element, having received none of it; and the cross-breds, which have received one dose only."

The element when present is dominant, that is to say it shows its effect whether this individual is pure-bred and so possesses a double dose, or cross-bred—simplex—possessing only a single dose. If an organism is pure-bred in any respect, all the germ cells are alike in that respect. If it is cross-bred, its germ cells represent in equal numbers the positive and negative elements which were brought together in (the) fertilization (from which it originated).

Leaving out, in the main, metabolic and nervous states, we find that Bateson sums up heritable malformations as follows:

Conditions Showing Dominant Descent.—Brachydactyly (as in Farrabee's well-known pedegree of five generations of a short-fingered Pennsylvania family), congenital cataract (Nettleship), claw-shaped extremities,* cartilaginous exostoses, membranous craniocleido-dysostosis, hypoplasia of the teeth.

In all these cases, says Bateson, unaffected members of the family do not transmit: not having in them the element which causes the condition they cannot pass it on, and as the individuals having the character are almost always cross-bred and of simplex type, *i.e.*, only one of their parents, not both, have possessed the character and passed it to them, so where a normal individual marries into such stock almost always there are approximately equal numbers of affected and unaffected offspring.

Conditions Showing Recessive Descent.—Of these there is less abundant evidence. In a cross-bred individual the recessive quality does not show itself; but if two cross-bred and therefore apparently normal individuals unite, one-quarter of the offspring may be pure, and therefore recognizable, recessives. Albinism and myoclonus are conditions of this order, but to our knowledge no skeletal defects belong to this category. But as Davenport has shown, feeble-mindedness is recessive, from which it follows that an obviously feeble-minded individual must be a pure recessive, and if he mates with another obviously feeble-minded individual, all the progeny will be feeble-minded, if with a "pure" normal individual none will be feeble-minded, if with a cross-bred normal, about half the progeny is likely to be feeble-minded.

Sex-limited Descent.—Included under this head are the conditions of peroneal atrophy (Herringham) color-blindness, and hemophilia together with some cases of pseudohypertrophic muscular paralysis. In all these cases the affected male mating with a normal woman has apparently normal offspring; apparently normal, but the daughters transmit the affection to half of their sons. Since this has little bearing upon skeletal conditions we will not burden the reader with the *modus operandi* of this mode of inheritance.

There was brought to my notice a few weeks ago a recent Paris thesis for the degree of M. D. on the out of the way subject of the inheritance among the Spanish Hapsburgs, of thanatomania,* or morbid enjoyment of the trappings and panoply of death. The author traced a succession of manifestations of this strange weakness through long generations, showing how it began with vanna la Folle who travelled around with the coffin of her late spouse Phillip I. as her constant companion, and reached its acme with Phillip II. who ended a week of masses for his father and mother by having a catafalque erected with a coffin in due place, in which he placed himself and had the inexpressible pleasure of listening to the mass for the dead chanted for himself, as if he himself had descended into limbo. And the writer parenthetically, while discussing the familial failings of the Spanish Hapsburgs, afforded a full study of the well-known "Hapsburg lip" or underhung jaw. This, which is recognizable in the present King of Spain, is traceable back as far as Duke Ernest of Austria who died in 1424, and the writer brings forward evidence to show that the inheritance was reinforced by the marriage of Maximilian I. (1459–1519) into the Burgundian family. It appears that Queen Eleonore, wife of Francis I. of France and sister of Charles V., finding herself in Dijon, showed her thanatomania by visiting the tombs of her ancestors the Dukes of Burgundy. At her request, the coffins of those ancestors were opened for her inspection, and as many of the corpses were in excellent preservation she made the discovery that they also had underhung jaws.†

It is extraordinary how, despite amphimixis and the mingling of new blood with the stock in successive generations, certain family traits remain thus dominant through centuries. Nor is this an isolated instance. Thanks to the interest taken in family histories among the good families of the United States, I have been able to trace the outcropping of polydactylism in one family back, if not to the Mayflower, to an ancestor presenting the condition who, migrating from England, settled at Woburn, Mass., in 1620. My friend, Dr. E. Brockbank of

*Mersey, L'amour de la Mort. Thèse de Paris, 1912.

†Vide Bouchot, prefàce to Galippe's "L'hérédité des stigmates de degenerescence et les familles souveraines," Paris, 1905.

Manchester, England, was so good as to institute enquiries there with the discovery of a family of the same name exhibiting to-day the same malformation in certain of its members, and the information was volunteered that some of this family migrated to America in or about the year 1620. It is clear therefore that the liability to present this deformity must have been present in the parent from whom the present American and English stocks trace their descent: in other words it must date back to the end of the sixteenth century at the latest.

My friend and colleague, Dr. A. C. Geddes, Professor of Anatomy at McGill, has given me a series of X-ray photographs, taken from a Shetland family in which the condition of "claw hand" and "claw foot" can be traced back to the first half of the seventeenth century. It is a delightful old world tradition. In the days of Charles I., when Archbishop Laud was doing his best to force Episcopalianism upon the Scottish people—to be eventually repulsed by Jennie Geddes with her stool in St. Giles's, Edinburgh—in the remoter Galloway region the emissaries of the Archbishop are said to have carried matters with a high hand, even to the extent of staking recalcitrants upon the sands of the Solway. The crime, it was held was not—or was more than—sufficiently serious that they should be condemned and executed by man: it was left to the higher powers to determine their fate. If they were innocent surely an all-wise Diety would not allow the inrushing tide to rise and drown them; if they were guilty, well—let them drown and good riddance. Church and State worked hand in hand in those days, and recalcitrancy in religion spelt disloyalty. And so it happened that a certain rugged royalist, Peter Bell, saw Margaret his betrothed, duly staked out, if he did not help in the process. But as the tide rose and seemed likely to overwhelm her, the sight was too much for his affections. He must give her the chance to save herself. Wherefore he rowed out to her. Said he, "Wull ye no say 'God save King Charles'?" And she: "No, I'll no say 'God save King Charles;' I'll say 'God save King Charles an he will.' " Taking all things into consideration it was a strictly logical and for the period reasonable answer.

It was but doing as she was being done by. But Peter Bell the first, thinking possibly of a future married state, construed it otherwise. "Na, Na," said he, "I canna save ye for that. Ye maun clap down amang the pairtins (crabs) and be drouned." Whereat Margaret: "The curse of the pairtins be on thee, Peter Bell, and on a' thy bairns for a' generations." The rising waters stopped further parley.

Now in due time Peter Bell took unto himself a wife and found himself waiting one night in the "but" anxiously expectant. Presently the "howdie" called out from within "Bell! Bell! thy bairn's born: he's clept, cleppit like a pairtin!" And ever since claw-handed and claw-footed individuals have occurred among his descendants for now five generations. Members of the family went to Shetland, and there many of the descendants exhibit the defect even to the possession of four "clawed" extremities. Rumour, indeed, has it that as the defect may lie latent, and the apparently sound male members of the family have a distinct predilection for military service, the defect has shown itself in the wake of Scottish regiments in Europe, in the Peninsula and low countries, and is beginning to show itself in India and various other regions of the world.

To the student of genetics these cases present problems of great interest. Its very persistence generation after generation in the direct line shows clearly that the property is dominant: in fact the Hapsburg lip is ultra-dominant. Even admitting that there have been numerous intermarriages of relations among the Hapsburgs, it shows itself too persistently to harmonize with the theory of probabilities as this bears upon the transmission of a simple dominant character. When the chances are even that a given feature either shows itself or is absent in any individual member of a family, we would be prepared to find the feature appearing in three or four successive generations, but not prepared to find it still there after fifteen or more generations. This is perhaps scarcely the place to enter into a full discussion of the conveyance in descent of unit characters. If any of our readers desire to gain a working knowledge of this subject quite the best and clearest exposition of these laws of descent is afforded by Professor H. E. Walter in his little work in "Genetics."* It might be suggested that the underhung jaw is a sex-limited dominant condition, in other words that the sperm cells which convey the attribute of maleness, convey also the attribute of "prognathism." Unfortunately, however, this does not harmonize with the known examples of sex-limited inheritance in man—with the genealogies of the color-blind and of families of bleeders. In them as already stated, the descent is of a different order, namely, such is the constitution of sperm cell and ovum respectively that the offspring of a color-blind father and a normal mother are *none* of them color blind, but the property of color-blindness is conveyed to the daughters, and the property reappears in one-half the number of their sons.

With polydactylism other complications show themselves. It is against our current conceptions that a dominant property when conveyed to the offspring should lie latent: if the property be present in the germ cells it should show itself in the individual; herein differing from a recessive quality. And yet in the pedigree of the family studied by me, the great grandfather was free from the defect although other members of the generation were affected; the grandfather was free, as was the father, although an uncle and aunt were polydactylous. Notwithstanding this absence of the condition for three generations in direct line, my student who afforded this pedigree had a complete functional extra digit on each hand and foot. This same tendency to latency of the condition has been observed in split or claw-handed families.

Davenport has attempted to explain such cases by variation in "potency" of particular determinants in different members of the same stock; the determinant may be there but "unable to complete its entire ontogeny." This, however, is only another way of saying that dominant characters may not be dominant in a particular generation.

Bateson, who frankly admits the difficulties, attributes the lack of conformity to the Mendelian rule in part to imperfection in records, in part to real peculiarities in the process of segregation of unit characters in the maturing germ cells. He points out that in hybridizing certain plants like wheat and peas, the expected numbers appear with great constancy, but in others, like stocks and primulas, long "runs" are so common that smooth results are only obtained by the summation of long series of observations.* Elsewhere† he suggests that the irregular results in polydactylism are to be ascribed to the dominant factor being inhibited or suppressed in consequence of this presence of other factors and with regard to split extremities admits that the degree of malformation is extremely irregular, and the number of affected persons higher than the expectation; concluding that it is improbable that any simple Mendelian scheme will express all these descents.

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* The Macmillan Co., 1913.

On the whole we are inclined to believe that in this order of deformities we have to take into account the distinction which de Vries has drawn between the crossing or hybridization of varieties and of species respectively. Varieties, he holds, consist in the apparent loss of some qualities active in the species: the presumably lost characters have not absolutely, or at least permanently disappeared. They show their presence by some slight indication of the quality they represent, or by occasional reversion. Recessive qualities are not wanting, only latent. Thus if two varieties of a species are paired, they constitute *balanced crosses*. Every quality in the one germ finds its mate in the other, whether active or latent: all the unit characters and their "allelomorphs" combine in pairs, exactly as is known to happen in ordinary fertilization.

Such it may be said, constitutes ordinary Mendelian hybridization, and for such Mendel's law is found operative.

But clearly deformities of the order here being discussed have originated as mutations; they are new properties which have appeared suddenly in the stock like the observed sudden appearance of short leggedness, in what starting from a single Massachusetts sheep in 1791 has been developed into the Ancon breed of sheep. Now as Bateson has emphasized, it is this discontinuity, or sudden appearance of a new property, that constitutes the development of a species—as distinct from a variety. If therefore an individual showing a mutation is paired with a normal individual, there results an *unbalanced cross:* there is something communicated by the one parent, which has no counterpart in the germinal matter communicated by the other parent.

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* Addresses on Heredity, XVII International Congress, of Medicine London, 1931.

† Mendel's Principles of Heredity, Cambridge, 1909, p. 228.

As de Vries has demonstrated, it is a mistake to imagine that the hybrids of distinct species are necessarily infertile. The last number of the Journal of Heredity for example, contains two interesting articles upon the formation of herds of "cattalos" —crosses between ordinary cattle and the American bison or buffalo. The interesting part of de Vries' observations is that such hybrids *do not conform to Mendel's law:* they exhibit the distinguishing marks of both parents. As far as the characters do not interefere with each other they may be fully developed side by side. Accompanying this all the individuals in each generation tend to be alike. There is not the sorting-out process seen in the second filial generation in true Mendelian inheritance. This order of events fits in more closely with the inheritance of the deformities in question than does the Mendelian order.

How do such mutations arise? That is a difficult question to answer. Nevertheless we appear to be approaching a solution of the question.

For us as medical men seeking to understand the cause of marked departures from the normal, the weak point of Mendelism is that it only covers a limited part of the territory. It does not pretend to—it can never—throw light upon progressive or regressive evolution. It can but explain the permutations and combinations of unit characters already possessed by the members of a species. It can go no further: it cannot explain the appearance of new unit characters, the development of new species.

This, we think, is not generally comprehended. We have to pass beyond Mendelism, for example, for an explanation of these heredity deformities, whether they be in the direction of excess or of defect.

It is along the line of chemical or physical alteration of environment that we most expect to gain the solution of these problems. Ultimately, as I have pointed out, on more than one occasion during the last ten years, the structure of matter depends upon its constitution, and it is by seeking to modify the chemical and physical environments of the germ cells that we are most likely in the first place to obtain alterations in the constitution of those germ cells, and secondarily alterations in the fully formed individuals developing therefrom. During the last few years work based upon this line of thought has been undertaken with certain striking results. I will not discuss the simplest case of all, namely, the development of mutants among bacteria by chemical alteration in their environment, but would call attention by Professor Tower's remarkable observations upon the potato beetle, in which by subjecting individual beetles as they approached sexual maturity to altered temperature conditions, he produced offspring differing markedly from their parents, and the rest of the species, in the markings upon their wing cases, and found that these crossed with each other, under normal temperature conditions, did not revert to the normal marking, but bred true to the induced alteration. Here the last few months have seen a notable advance in the observations of Stockard of New York upon alcoholized guinea-pigs. His observations are to be found in detail in the "American Naturalist," vol. xlvii, November, 1913.

It may be noted in brief that Stockard found that by subjecting guinea-pigs to the fumes of alcohol he could cause a daily mild stage of intoxication over several months without obvious disturbance of the general health, the animals, indeed, fattened under the process. But this told upon their descendants. Even where the bucks alone were so treated—the crucial test—there was an increased number of sterile matings, and of permature births; the litters were smaller, there was a pronounced increase in the number of the young dying within a few days after birth, while those that survived were stunted. And here is the interesting point: if he took these offspring of alcoholized parents, which themselves had never even smelt alcohol, and mated them, their progeny was defective, often even more defective than their parents and presenting definite deformities, such as lack of development of the eyes with associated cranial malformations, and imperfect development of the limbs. Stockard, thus, is the first who has succeeded in so treating warm-blooded animals, experimentally, as to demonstrate that *hereditary* degenerations and defects may be induced by the action of different chemical agents upon the germ cells. I have for many years taught that this must be the case, that a large proportion of the deformities we encounter is due to intoxication of the germ cells of one or other parent, whether by the toxins of infectious disease, or by one or other drug; indeed, years ago, feeding guinea-pigs with minute doses of soluble lead salts, I attempted to carry out, without success, what now with alcohol Stockard has so brilliantly and so ingeniously accomplished.

The appearance then of deformities in any stock is not a chance affair; nor have we to content ourselves with the thought that the defective trait of necessity dates back to tendencies that have been latent or obvious in the stock for long generations. It may date back only to influences telling upon the germ plasm of parent or grand-parent. The germ cells can be acted upon and so we may influence the derivative germ cells of future generations, and what is more the changes and their effects may be intensified by inbreeding, or the mating of those presenting like defects.

To the readers of this Journal it would be absurd to propound that all malformations are inherited. It goes without saying that there is a distinct group of disturbances of congenital origin, due to the mechanical effects of pressure, lack of adequate amniotic fluid, disease, etc., *in utero*. But even here Bateson has an interesting observation. While conditions of hallux valgus dislocation of the hip or radius and other deformities attributable to intrauterine disturbance most frequently affect but a single member of a family, it will be familiar to the readers of this Journal, that occasionally we encounter several members of a family possessing defects of this nature, and what is more, in certain families the conditions may be transmitted from parent to offspring. Bateson compares these phenomena with those often noted in incubator eggs—"When the incubators are mismanaged, many of the chickens are born with deformed feet. Such abnormality, however, is found with especial frequency in particular strains of birds (for), eggs from other strains exposed to the same condition may give perfectly normal results."

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ABSTRACTS

I. TUBERCULOUS LESIONS OF BONES, JOINTS AND TENDONS. GENERAL ARTICLES ON TUBERCULOSIS.

Conservative Measures in Treatment of Surgical Tuberculosis. By Mr. H. J. Gaupain, Medical Superintendent of the Lord Mayor Treloar Cripples' Hospital, Alton. *Lancet*, Nov. 1.

An exposition of the conservative methods in use at Alton, laying stress on the fact that tuberculous disease is a general disease with local mainfestations. Treatment, therefore, should be general as well as local.—*J. Appleton Nutter, Montreal.*

Treatment of Bone Tuberculosis by Exposure to Sun and Air. By S. Kofmann. *Zeit. für orth. Chir.*, 1913, Bd. XXXII.

Author has had excellent results in bone tuberculosis cases by exposure to sun and air. Abscesses and sinuses particularly, as a rule, heal very promptly.—*Geo. I. Bauman, Cleveland, Ohio.*

The Importance of Orthopedic Treatment in Tuberculous Joints, Based Upon Twenty-five Years' Experience in Four Thousand and Ten Cases. By Arthur J. Gillette, St. Paul. *Journal-Lancet*, Jan. 1, 1914, Vol. XXXIV, pp. 4–12.

The author makes the point that in almost every case of joint inflammation there are present deformity, fixation, atrophy of muscles and more or less pain. These are present in tuberculous joints, but, in addition, the history of gradual onset is to be elicited and is the most important diagnostic point. Dr. Gillette hands the opsonic index. Von Piquet and ophthalmotuberculin reaction have not been satisfactory and are not used. He feels sure that Koch's original tuberculin has in some instances resulted quite disastrously. The X-ray assists very little in distinguishing tuberculosis from other bone diseases. Speaking of prognosis, he states that of 250 traced cases of tuberculosis of bones and joints, there were 80 per cent. cures, meaning by cures those cases no longer giving any evidence of any active disease, no apparent deformity and a good functional limb. Under treatment established, orthopedic measures are advocated. Some of the commoner errors made by the general surgeon in the treatment of these cases are pointed out. The paper was read before the Minnesota State Society.—*M. S. Henderson, M.D., Mayo Clinic, Rochester, Minn.*

Regarding a Benign Form of Primary Tuberculous Pyarthrosis without Bone Lesions. By Chalier and Maurin. *Rev. d'Orth.*, Jan., 1913.

The authors present three cases with the above characteristics. The clinical pictures in two cases (knees) suggested a simple hydrarthrosis, in the third (elbow) the picture was of an infectious arthritis. The lesions were confined to the synovial membranes, but in spite of their benignity there was no tendency toward resorption. The pure tuberculous nature of the evacuated pus was demonstrated by culture and by the inoculation of laboratory animals.

The striking feature in all three cases was "the almost complete integrity of the joint functions." Another noteworthy point was the good general condition of these patients, in striking contrast to the classical picture in cases of complete tuberculous pyarthrosis.

Treatment consisted in evacuation by puncture in the case of the two knees, and by arthrotomy in the case of the elbow. Rapid recovery, with excellent function of the joints resulted.

The authors believe these cases represent a distinct type of tuberculous joint infection, and one not referred to in previous classifications, among which they mention particularly those of Koenig and of Bonnet.—*Roades Fayerweather, Baltimore.*

La Tuberculose Inflammatoire. By A. Poncet and R. Leriche. Doin et fils, Paris, 1912. Book reviewed by Patel. *Rev. d'Orth.*, March, 1913; p. 190.

In this book the authors expound their views regarding the tuberculous nature of many inflammatory lesions, of bones, joints and soft parts, in which the ordinary proofs of tuberculous infection are not to be found. Many articles by these authors have been abstracted in this journal (AM. JOUR. ORTH. SURG.). It is intended here only to call attention to the book, and to its review by Patel, who has recapitulated in a helpful way the various subjects discussed in the book.

Roentgen-ray Treatment of Joint Tuberculosis. By Julias Hass. *Zeitschrift f. Orth. Chir.*, Bd. XXXIII, H. 1–2, p. 259.

The author has employed massive doses of the Roentgen rays in treating tuberculosis of the hip-, knee-, ankle-, and elbow-joints. A filter is used to protect the skin from the burning rays.

The synovial types of tuberculosis usually show marked improvement under this treatment. The osseous types were not benefitted in the authors' experience. He ascribes this to the absorption of the rays by the superficial layers and their failure to reach the deep layers of bone in sufficient strength. The cases in which sinuses are present are usually cured, even when secondary infection has occurred.

The shorter the duration of the disease, the swifter is the cure. Therefore, this method of treatment should be employed as early as possible. As in the sunshine treatment, it should be combined with the usual orthopedic therapy.—*A. Bruce Gill, Philadelphia.*

Results of the Open Operation for Deformities of the Hip-joint and the Knee-joint due to Tuberculosis. By Bocker. *Zeitschrift. f. orth. Chir., Bd.* XXXIII, H. 1–2, p. 188.

As is well-known, tuberculous disease of the hip and knee-joints very often heals with the limb in bad position. Ankylosis and contractures and shortening are all too frequent sequelæ of this disease. Various means have been employed to cure these deformities; forcible correction, open operation on the joints, various forms of osteotomy. No dogmatic rule can be given. The author prefers osteotomy to arthoplasty as he fears the latter may kindle again the tuberculous process. A wedge-shaped resection is also useful in certain cases. In the treatment of acute tuberculous processes conservative treatment is much better than operative treatment. —*A. Bruce Gill, Philadelphia.*

Treatment of Bone and Joint Tuberculosis at Berck. By V. Menard. *Zeit. für orth. Chir.*, 1913, Bd. XXXII.

One of the greatest advantages of the treatment at Berck is that the patients are out on the beach a great part of the day. Author thinks that the ozone, iodine and bormine contained in the air have a beneficial effect. When possible the patients bathe in the sea-water. Treatment lasts from three months to two or three years. Abscesses are punctured when necessary. Plaster is used to overcome pain and deformities (including the hyphosis in Potts' disease). Author recommends heliotherapy in all sinus and abscess cases. If the spine cases are treated by recumbency (aided if necessary by special apparatus or plaster corsets) for two and one-half to three or four years there will be little or no deformity.—*Geo. I. Bauman, Cleveland, O.*

Heliotherapy in Bone and Joint Tuberculosis. By A. Rollier. *Zeit. für orth. Chir.*, 1913, Bd. XXXII.

Surgical tuberculosis is a local manifestation of a general infection, therefore the exposure to the sun and air should be general. The sun and air act as a general tonic and as a local bactericide. The patient is kept in bed and only sufficient apparatus (usually simply pads, pillows, splints or extension) used to aid in correcting existing deformity. The exposure is started in very small doses and very slowly increased until finally the whole body is exposed. Potts' disease cases are kept on the abdomen a large part of the time. Pain and fever disappear very quickly. Motion returns to a very large extent. Fistulæ and abscesses heal promptly.

In the absence of sun the X-rays are used with good results. The treatment has been successful in all forms of surgical tuberculosis.—*Geo. I. Bauman, Cleveland, O.*

Tuberculous Rheumatism. By Nathan Raw, M. D., F. R. C. S., *Edin. Lancet*, Jan. 3, 1914.

From an observation of over 6000 cases of pulmonary tuberculosis the author has never met with a single case of tuberculous rheumatism, at least, it was not recognized as such.

Case reports follows of a girl of nineteen years, with primary tuberculosis of the cervical lymph glands. One month following operation for removal of softening glands the patient developed a painless, rapid effusion in both wrist joints, and later all the metacarpo-phalangeal joints. Fluid from wrist-joint failed to show tubercle bacilli, but contained an excess of lymphocytes. This, of course, is in favor of tuberculosis, as in true rheumatism the fluid would show predominance of polymorphonuclears.

Author has seen two other cases of tuberculous rheumatism similar to above, both of which suffered from tuberculous glands of the neck. This last condition is in his opinion almost always caused by the bovine bacillus; while pulmonary tuberculosis, which is now frequently the result of infection by the human bacillus, very rarely gives tuberculous rheumatism. It would seem that the bovine bacillus is much more likely to find its way into the joints.—*J. Appleton Miller, Montreal.*

The Origin of Contracture of the Hip in Tuberculous Coxitis. By R. Werndorff. *Zeit. für orth. Chir.*, 1913, Bd. XXXII.

Author draws following conclusions: If the disease affects the synovia only the leg is abducted, flexed and rotated outward. If there is destruction of head or acetabulum the leg is adducted, flexed and rotated either in or outward. Isolated bony or synovial foci cause atypical positions and give characteristic changes in the range of different motions. The development of these various contractures is brought about by many different forces, chief among which are weight-bearing and muscular atrophy.—*Geo. I. Bauman, Cleveland, O.*

Results of Bone Plastic and Graft Operations on the Spine for the Cure of Pott's Disease. John J. Nutt, M. D., N. Y., *J. A. M. A.*, Nov. 15, 1913.

This report is based on the examination of fifteen cases, operated by other men and the study of their history sheets.

The author feels that the main danger of the operation is the sense of false security that is given and therefore the neglect of other measures.—*Edward S. Hatch, New Orleans.*

Physical Treatment of Joint Diseases, Especially Tuberculosis. By M. Wilms. *Zeit. für orth. Chir.*, 1913, Bd. XXXII.

Author speaks favorably of the results in the treatment of acute and chronic rheumatism by X-rays, radium and thorium. He also feels more certain of the permanency of the results in surgical tuberculosis treated by exposure to the sun and air and to the X-rays than by any operative measures.—*Geo. I. Bauman, Cleveland, Ohio.*

Light Treatment of Surgical Tuberculosis. By O. Vulpius. *Zeit. für orth. Chir.*, 1913, Bd. XXXII.

Without in any way depreciating the excellent results obtained by heliotherapy in the higher altitudes author wishes to emphasize the fact that excellent results are also obtained in the lower or medium high altitudes, as in the Rappenau sanatorium under his care. Here artificial light (chiefly ultraviolet-rays) has been used in conjunction with the sunlight with very good effects. In this way the patient can be kept under light treatment (local and general) at all times.—*Geo. I. Bauman, Cleveland, Ohio.*

Results in Open Operation in Tuberculous Hip and Knee Deformities. By W. Böcker. *Zeit für orth. Chir.*, 1913, Bd. XXXII, Heft 1–2.

Author reports a number of cases in which he did osteotomy or wedge-shaped resection for deformities resulting from joint tuberculosis. Good results. There is nothing new in the treatment.—*Geo. I. Bauman, Cleveland, Ohio.*

Cardinal Principles in the Management of Bone Tuberculosis. By Fred. J. Fassett, M. D., Seattle, Washington. *With West-Medicine*, February, 1914, Vol. VI, No. 2.

The author treats the subject under the following headings. Early and accurate diagnosis, rest; the prevention of deformity, fresh air, good food, the prevention of mixed infection, operation when necessary.

The paper contains nothing new to the orthopedist, but is valuable for the general practitioner, especially as it contains a forcible and much needed warning against the indiscriminative diagnosis of rheumatism. —*Archer O'Reilly, St. Louis.*

Treatment of Pott's Disease of the Spine. By Geo. B. Packard, M. D., Denver. *Colorado Medicine*, July, 1913, Vol. X, No. 7.

The author outlines in general the treatment of Pott's disease, and lays especial stress on the value of recumbency in the prevention of deformity. —*Archer O'Reilly, St. Louis.*

II. PARALYTIC DISEASES AND THEIR DEFORMITIES. NERVE LESIONS WITH ARTHROPATHIES.

Muscle Displacement in the Treatment of Paralytic Deformities. By Kofmann. *Zeitschift. f. orth. Chir.*, Bd. XXXIII, H. I–II, p. 107.

In the operation of muscle displacement the tendon is not severed from its origin or its insertion, but the course of the tendon is altered so that it exerts its tension in a different direction than formerly. For example, the tibialis anticus muscle acts both as a dorsal flexor and as a supinator of the foot. If its tendon be moved over toward the internal malleolus it will then exert its power more directly in lifting the inner border of the foot and its function as a supinator is increased. This procedure finds its indication in pes valgus. If the tibialis anticus is active its tendon may be displaced to the internal malleolus and passed beneath a flap of periosteum which will act as a pulley for the tendon. If the muscle is paralyzed it may be fastened in the same position in a hole cut in the bone beneath the periosteum, when it will act as a ligament to hold up the inner side of the foot.

In a similar manner one or both of the peroneal tendons may be displaced forward and passed beneath a flap of periosteum on the external malleolus to exert a greater force in elevating the outside of the foot in cases of pes varus.

The sartorius may be moved over the rectus femoris and fastened beneath the periosteum of the patella and a strip of the fascia lata may be taken and fastened to the patella so that the tensor fascial femoris may act as an extensor of the leg.—*A. Bruce Gill, Philadelphia.*

New Treatment of Poliomyelitis. By D. H. Moulton, M. D., Chicago, *California State Journal of Medicine*, Feb., 1914, Vol. XII, No. 2.

The author reports the treatment which is being used by Roy Bernard, M. D., of Chicago. It is based on the theory that adhesions result from the inflammatory process resulting in an anemia. The treatment aims to break up the adhesions. This can be accomplished by stretching the cord. This is done by suspending the body with the support just above the affected portion of the spine. If in the lumbar region the support would be at the ninth, tenth, and eleventh dorsal vertebræ. The patient's spine is raised from the table and allowed to rest in that position until the muscles relax, about a minute, then the body is gently swung backward and forward and rotated for about three minutes. This treatment is repeated every second and third day.

The object is to obtain an increased blood supply to the involved areas which aids absorption and stimulates vasomotor function. This in turn nourishes the cells with a resultant regeneration of the nerves and growth of the atrophied muscle. This will result if there are any undestroyed nerve cells present. Five sample cases are given, which all showed remarkable improvements. In several this treatment was begun one to two years after the attack.

The author is very enthusiastic and says he has visited and seen case after case which had been cured.—*Archer O'Reilly, St. Louis.*

Treatment of Infantile Paralysis. By George I. Bauman, M. D., Cleveland. *Cleveland Medical Journal*, October, 1913, Vol. XII, No. 10.

A short article giving a brief general summary of the treatment of infantile paralysis. The author dwells rather more extensively on the operative treatment. He favors arthrodesis, but does not mention the Whitman operation. The paper contains nothing new.—*Archer O'Reilly, St. Louis.*

The Treatment of Paralysis of Anterior Poliomyelitis. By. H. W. Frauenthal, M.D., New York, *J. A. M. A.* Dec. 20, 1913.

The author describes his treatment of the paralysis, first, by electricity high-frequency currents combined with faradic and galvanic currents which contract seventy-two times to the minute, and the sinusoidal current. Second, massage started early and continued for long periods. Third, muscle education, active and passive exercises done before a mirror, even when the child can only try to do the exercise without succeeding at all.

Sixteen cases are reported of various grades and the results are extremly encouraging.—*Edward S. Hatch, New Orleans.*

Principles of the Treatment of Infantile Paralysis. By R. W. Lovett, M. D. Boston, *J. A. M. A.*, Jan. 24, 1914.

Hexamethylenamin is advised in the early stages.

Rest in the acute stage, and active treatment as soon as tenderness is gone. Massage and muscle training offer the best results, malpositions must be corrected with braces. Deformity if existing must be corrected by operation.—*Edward S. Hatch, New Orleans.*.

Report and Remarks in a Small Epidemic of Poliomyelitis. By Paul B. Roth. *Lancet*, Nov. 15, 1913.

The cases occurred in close proximity to stables, and the writer suggests that the infection was transmitted from one patient to another through the tribe of stomoxys calcitrans.

Outbreak of Acute Anterior Poliomyelitis at West Kirby. By George Jubb, M. D.

Here the author is inclined to attribute the infection to the bite of a louse. *J. Appleton Nutter, Montreal.*

Case of Spasmodic Torticollis. By Dr. R. Barclay Ness. *Glasgow Medical Journal*, Nov., 1913.

Male, twenty-two years. First attack two years ago in the U. S. A. Carried sheet iron on left shoulder, and constantly directed head and eyes to left to maintain balance. Was treated by massage and electricity, cured after three months.

Present attack came on three and a half months ago—and has again been brought on by his occupation. He has to keep his head turbed constantly to the left to watch a saw. This first led to tiredness in his neck, then spasms with some discomfort or even pain. Shows typical deformity of wry-neck, and can even maintain his head in overcorrection with an effort of the will. When the effort is no longer made the head again turns to left. In sleep the deformity passes. Personal and family history negative. Treatment suggested is rest, feeding, sedatives, massage and electricity, with possibility of nerve resection if such measures fail.—*J. Appleton Nutter, Montreal.*

Some Additional Experiences of Nerve Surgery.—By A. H. Tubley, London. *Lancet*, Nov. 8, 1913.

Case reports of numerous cases. Deductions. 1. Brachial plexus lesions, if traumatic are hopeful, if the loss of power has not existed for years. If due to other causes the outlook is not so good. However, we should not despair of a case recovering even five years after operation, providing improvement has set in three months after operation and is continuous.

2. Popliteal neuroplasty for infantile paralysis has proved disappointing for reasons given previously.

3. Injuries about the wrist should never be sewn up until the continuity of the nerves has been ascertained, and until all the electrical reactions have been tested.

4. If the lesion of the nerve is compressive by a scar, the outlook after operation is most hopeful. If the nerve has been severed primary operation is very hopeful, but secondary suture rarely permits a complete recovery.

5. No case, however, of traumatic nerve lesion should be regarded as hopeless, in view of the achievements of neuroplasty.

A New Operative Treatment for Spastic Paralysis. By W. Sharp, M. D. and B. P. Farrell, M. D., N. Y., *J. A. M. A.*, Nov. 29, 1913.

This is a preliminary report in which the authors report two cases, the usual operations for spastic paralysis are mentioned and this operation which is a decompression is advised in the hemiplegic types which show increased intracranial pressure by ophthalmoscopic examination. They report excellent results.—*Edward S. Hatch, New Orleans.*

Charcot Joints as an Initial or Early Symptom in Tabes Dorsalis. By Henry L. Taylor, M. D., N. Y., *J. A. M. A.*, Nov. 15, 1913.

All cases of charcoat joints are probably luetic, and are often early symptoms of tabes. Many of the cases go undiagnosed during the early stages of the disease. The X-ray is of great value in clearing up these cases. Mixed treatment is of no use but orthopedic appliances often do good.—*Edward S. Hatch, New Orleans.*

Nerve-transplantation. By G. Frh. v. Saar. *Zeit für orth. Chir.*, 1913, Bd. XXXII.

A part of the radial nerve was resected on account of a tumor and the lower stumps implanted in the median. Return of power in many of the muscles supplied by the radial.—*Geo. I. Bauman, Cleveland, Ohio.*

III. METABOLIC DISTURBANCES CAUSING BONE AND JOINT DISEASES. INFECTIOUS ARCHTITIS, OSTEOMYELITIS, ETC.

Acute Leukemia Simulating Caries of the Spine. By H. D. Rolleston, M. D., F. R. C. P. and C. H. S. Frankau, M. B., F. R. C. S. *Lancet*, Jan. 17, 1914.

Case report of boy of five, admitted for pain in the back following fall. Vertebræ tenderness and muscular rigidity. Diagnosed acute vertebral tuberculosis. Blood count showed white count of 14,800. Eighty-one per cent. lymphocytes. Postmortem examination showed bone marrow changes characteristic of leukemia.

The simulation of spinal cases by leukemia is unusual.—*J. Appleton Nutter, Montreal.*

Haemophiliac Joints. By Mankiewicz. *Berlin. klin. Wochensch.*, Nov. 24, 1913, p. 2174.

These joints undergo pathological changes in the course of the disease. which may be divided into three stages: 1. stage of bleeding; 2. stage of inflammation; 3. state of deformity and contracture. The author describes the well-known pathological changes, and then discusses the diagnosis by the Röntgen method, which he claims is possible, even when the patient is not known to be a bleeder. In the Röntgen plate, the lower end of the femur is smaller on the deformed side; all the bones of the extremity involved are atrophic and show increased radiability to the Röntgen ray. The epiphyseal line is irregular and jagged. On account of atrophy of cartilage the space between the bones is diminished. The bony ends are irregular and jagged, the normal contour of the condyles is changed, and the intercondylar eminence is broadened. Three cases with röntgenologic changes are reported.—*Roland Hammond, M. D., Providence, R. I.*

Bone and Joint Syphilis. By Axhausen. *Berlin. klin. Wochensch.*, Dec. 22, 1913, p. 2361.

The author reviews the tardy manifestations of syphilis in bones and joints and cities illustrative cases. The gummatous form is most common. The diffuse form, involving a large extent of bone is frequently mistaken for fibrous ostitis or sarcoma. The process may develop suddenly with acute symptoms, or the onset may be insidious as in chronic polyarthritis. He has a Wassermann test made on every patient, and since doing this has discovered several cases which had previously been treated for tuberculosis without benefit. Administration of anitsyphilitic treatment resulted in prompt cures. Without treatment, ankylosis will probably result. With proper treatment, the results are speedy and satisfactory. Salvarsan has given excellent results in his hands. He uses it in adults and older children, but not in the case of young children. He cites many instructive cases, all of whom had been treated for some other condition,who responded promptly to antisyphilitic treatment.—*Roland Hammond, M. D., Providence, R. I.*

Report of a Case of Chronic Articular Rheumatism—Phylacogen Treatment. By Herbert A. Brown, M. D., Cincinnati. *The Lancet-Clinic*, Nov. 1, 1913, Vol. CX, No. 18.

The case is one of chronic articular rheumatism in both knees, duration four years, following an acute onset. There had been repeated attacks and the patient had been unable to walk with comfort. In September, 1913, there had been another attack which failed to respond to large doses of sodium salicylate. It had been cured, apparently, by eight doses of phylacogen. Up to November there had been no return.—*Archer O'Reilly, St. Louis.*

Osteitis Deformans, Central Sarcoma, Striptococcus Infection. By Joseph Ransohoff, M. D., F. R. C. S. (Eng.), Cincinnati, Ohio. *Lancet, Clinic,* December 27, 1913, Vol. CX, No. 26.

The author describes a case of osteitis, in which a central sarcoma developed, which was complicated by an extensive streptococcus infection. The leg was amputated through the lower third of the thigh. A fairly extensive pathological report is given and two X-rays are shown.

The author thinks that development of a central sarcoma in the case interesting, and remarks that many pathologists do not consider it a sarcoma, but rather a modified form of osteitis deformans. The author does not agree with this, and states that most central sarcomata are distinctly limited, and when the bone is perforated they become very malignant. The first case of osteitis deformans described by Paget, died of a tome sarcoma of the forearm. An interesting feature also is the rapid spread of the streptococcus infection through the whole length of the diseased medulla.—*Archer O'Reilly, St. Louis.*

Report of the Case of Acute Epiphysitis of Femur—treated First for Rheumatism. By Eugene B. Gland, M. D., Ashville, N. C. *The Lancet Clinic*, February 7, 1914. Vol. CXI, No. 6.

The author defines acute epiphysitis as acute osteomyelitis or acute infantile arthritis, without a wound. He briefly describes the etiology, pathology and treatment. He reports a case in which a boy had injured knee, followed in three weeks by a stone bruise, and one week later developed a severe pain in the right knee near the joint. This was diagnosed as rheumatism, and treated as such for seven weeks. When seen by the author the whole femur and hip-joint were involved. The child was in such a condition, that an amputation at the hip-joint was necessary. After this, there was an uneventful recovery.—*Archer O'Reilly, St. Louis.*

The Early Treatment of Inflammatory Diseases of Joints. By Heinrich F. Wolf. *Zeit. für orth. Chir.*, 1913, Bd. XXXII.

Many cases of ankylosis could have been avoided by proper treatment during the acute stage. Author's idea of the proper treatment in this stage (except in tuberculosis or streptococcus infection) is Bier's hyperemia, massage, passive motion and early use.—*Geo. I. Bauman, Cleveland, Ohio.*

Concerning the Nature of Arthritis Deformans. By Axhausen. *Zeitschrift. f. orth. Chir.*, Bd. XXXIII, H. 1–2, p. 223.

The author experimentally produced a typical arthritis deformans in the knee of a dog by opening the joint and producing by electrolysis a necrosis of the cartilage.—*A. Bruce Gill, Philadelphia.*

Typhoid Spondylitis. By Verdoux. *Rev. d'Orth.*, Sept., 1912.

The list of previously reported cases comprises but ninety-seven. To this the author adds one new case. The salient points are: During convalescence from a fever lasting 108 days, in a girl of seventeen years, suppurative foci appeared in the bones of the right hand and left foot, simultaneously with a painful spondylitis of the lumbar region. The former required surgical intervention; the spondylitis disappeared after two months in bed. The unusual feature was the early appearance of the suppurative osteitis and the spondylitis, during the first days of convalescence from typhoid fever.—*Roades Fayerweather, Baltimore.*

Chronic Arthritis. By Lindsay S. Milne, M. D., Kansas City, Mo., *J. A. M. A.*, February 21, 1914.

This subject is taken up from the degenerative side, and also as to the etiology and pathology.

The author feels that all cases of chronic arthritis are due to some infective agent, and that the great variety of types depend on the severity of the infective agent, and the duration of time that the joint is exposed to it.

Much can be done with the cases that come without any sign of infective process, when the disease is stationary by munipulative and operative measures.—*Edward S. Hatch, New Orleans.*

Chronic Streptococcus Arthritis. By John J. Davis, M. D., Chicago, *J. A. M. A.*, Sept. 16, 1913.

The author believes that there is a definite group of these cases which should be distinguished from arthritis deformans.

The tonsils are usually found diseased. Autogenous vaccines are useful in these cases. The streptococci isolated from these cases do not seem to be as virulent as ordinary pyogenic streptococci.—*Edward S. Hatch, New Orleans.*

Osteochondritis Dissecans. By John Ridlon, M. D., Chicago, *J. A. M. A.*, Nov. 15, 1913.

Three cases are reported, and the röntgenograms shown.

"There is nothing to be learned from these cases except that they may go on for years giving little trouble, and our present knowledge of this condition does not warrant us in discussing its relation to other loose bodies in the knee-joint."—*Edward S. Hatch, New Orleans.*

IV. BONE AND JOINT TUMOR, BENIGN AND MALIGNANT.

Regeneration of Bone from Periosteum. By L. L. Hass. Abstract from the *Journal of Surgery, Gynecology and Obstetrics*, August, 1913.

A long series of experiments on rabbits. From which he finds that blood clot stimulates periosteal regeneration. Fragments of bone without periosteum do not regenerate bone. The whole periosteum should be used.—*Z. B. Adams, Boston.*

Cystic Disease of Bone. By Mr. Henry Rutherfurd. *Glasgow Medical Journal*, March, 1914.

1. Boy of fourteen. Cystic disease of upper end of humeral diaphysis, treated by free opening and implantation of rib. X-ray showed expansion of the bone with rarification. At operation a thin shell with projecting trabeculæ was found; walls quite bare; no lining membrane or soft tissue; contained a yellow serum. The implanted bone seemed to have become consolidated later. Joint not touched.

2. Girl of eight. Cystic disease of upper end of humeral diaphysis; not yet operated on.

Neither case had a history of pain, contrasting, in this respect, with what is common in central sarcoma.

Spinal column of a boy of six years, the seat of multiple tuberculous foci (cervical, dorsal and lumbo-sacral). Mr. H. Rutherford and Prof. J. H. Teacher.

Child admitted for lumbar Pott's disease with iliac abscess. Paraplegia and death followed. Postmortem of the laminal and spinous processes in the dorsal region, but no disease of the vertebral bodies in that region. A tuberculous growth was invading the spinal cord in the cervical region. There was also extensive tubercular disease of the lumbo-sacral vertebræ. —*J. Appleton Nutter, Montreal.*

A Case of Bony Torticollis. By George Müller. *Berlin. klin. Wochensch.*, Jan. 26, 1914, p. 152.

The patient was an eleven-year-old boy, who had been operated upon one year before. A myotomy of the right sternomastoid had been performed without relief. Röntgen examination showed fusion of the second, third, and fourth cervical vertebræ on the right and wide separation of the same vertebræ on the left side. Spina bifida occulta and defects in these vertebræ were also seen, but otherwise these vertebræ were well developed. The three lower cervical and the upper thoracic vertebræ were atrophic and apparently fused, and rudimentary cervical ribs were observed on the three lower cervical vertebræ. Vertical traction was recommended, in the hope of producing growth of the vertebræ on the side of the deformity.—*Roland Hammond, M. D., Providence, R. I.*

Bone Necrosis and Sequestrum Formation. By Professor Axhausen. *Deutsch. medezin. Wochensch.*, Jan. 15, 1914, p. 111.

Axhausen believes that bone necrosis and sequestrum formation are not identical. Sequestrum formation presupposes infection and necrosis, but it is really something more than the combination of those two conditions. Following prolonged suppuration, comes a line of demarcation in the necrosis, and then new bone growth follows. In this connection of the new bone with the living periosteum, we have the only result of bone necrosis. The author has made histological studies after subjecting bone to the effects of cold, chemicals and electricity. He finds the truth of his statement borne out. It is not necessary that necrosis should go on to sequestrum formation.—*Roland Hammond, M. D., Providence, R. I.*

Ostechondritis Dissecans Traumatica. By W. Friedrich. *Zentralblatt f. chir. u. mech. Orthopædie,* Oct., 1913, p. 401.

Friedrich reports a case from Vulpius' clinic, where a captain of thirty-five years after a strain of the knee-joint has been suffering from swelling, weakness, tenderness on the inner gap and pain in forced motions. At the operation a small piece of cartilage on the inner condyle of the femur was found to be necrotic, lying in a somewhat larger hole, the bottom of which was formed by bone. After removal of the necrotic piece and a small area around it recovery took place in a short time. The diagnosis was made "osteochondritis dissecans" and not a simple tearing off of cartilage, because the injury was not very severe and the seat of the necrotic piece was on the height of the convexity of the condyle, a considerable distance from the insertion of the posterior ligamentum cruciatum.—*C. H. Bucholz, Boston.*

Benign Growth in Tibia of Boy. By Mr. V. Warren Low. *Lancet,* Jan. 31, 1914.

Hard and firm swelling of tibia, following one month after vague history of injury of ankle. Dated from 1908. Some pain caused on walking about. No evidence of tubercle or syphilis, and cortex was not unusually thick. Cancellous tissue seemed unusually soft when tibia was opened Growth gradually becoming larger. Pathological diagnosis, central ossifying myxofibroma of tibia. A fracture had occurred through the tumor, and had united readily.

Mr. Low also showed case of (?) enchondroma of lower end of femur underlying calcification in youth of seventeen.—*J. Appleton Nutter, Montreal.*

V. SCOLIOSIS AND STATIC DISTURBANCES.

Lateral Curvature. By E. G. Abbott. Abstract from the *Journal of Surgery, Gynecology and Obstetrics*, August, 1913.

The deformities of scoliosis are thought to be similar to the deformities of club-foot, and to be due to faulty posture. From this he reasons that to correct the condition a similar reverse deformity should be produced. This he thinks he obtains by flexion and lateral pull, and applying a plaster jacket while the case is held in position on his frame. He increases the distortion thus produced, by adding pads inside the jacket.—*Z. B. Adams, Boston.*

Treatment of Lateral Curvature. By Dr. Whitman. Abstract from the *Journal of Surgery, Gynecology and Obstetrics*, August, 1913.

Discussing Dr. Abbott's paper, Dr. Whitman thinks Dr. Abbott has added new zest to an old subject, but feels he claims more than the results from the treatment warrant.

Coxa Valga. By K. Vogel. *Zeit. für. Orth. Chir.*, 1913, XXXII.

Coxa valga may result from too prolonged extension or abduction in the treatment of fracture of the upper end of the fumur. Rickets may be the cause in some cases and others are congenital. The unilateral cases are usually those with congenital dislocation of the hip and the coxa valga in these cases is most probably due to the manipulation and prolonged fixation in abduction.

The acquired cases are due either to an excessive production of bone on the under side of the neck in cases of injury to the epiphysis or to the "favoring" of, or the lessening of pressure upon a painful hip.—*Geo. I. Bauman, Cleveland, Ohio.*

Genu Valgum in the Radiograph. By Gustav Molineus. *Zeit für orth. Chir.*, 1913, Bd. XXXII.

It is difficult to say why genu valgum appears in certain individuals and why the deformity is more pronounced in the upper end of the tibia in young children and in the lower end of the femur in the older children. There is no question that in young persons the end of the bone is low in lime content and hence more liable to deformity following injury or unusua strain.

The above-mentioned location of the greatest deformity at different ages should determine the seat of an osteotomy. Radiographs therefore should always be taken before doing an osteotomy. Epiphyseolysis may give an ideal result in certain cases but is too liable to be accompanied by injury to other structures.

Author reports a large number of cases with the radiographic findings to illustrate the points mentioned above.—*Geo. I. Bauman, Cleveland, Ohio.*

Coxa Vara. Etiology, Pathology, Treatment. By M. Perrin. *Rev. d'Orth.*, July, Sept. and Nov., 1912.

This study is in the nature of a monograph, covering 120 pages of text and occasional illustrations, to which is appended a bibliography of over 200 references. Attention is directed mainly to cause and treatment. Perrin acknowledges no diagnosis which is not confirmed by radiograms showing an angle of less than 125° between neck and shaft.

The following etiological classification is substituted:

(1) Congenital coxa vara; (2) Coxa vara of Congenital dislocation of hip; (3) coxa vara of infantile rickets; (4) coxa vara due to osteomalacia; (5) coxa vara due to osteites fibrosa; (6) coxa vara consequent upon a neoplasm of the upper part of femur; (7) coxa vara due to tuberculous disease of the head or neck; (8) coxa vara in arthritis deformans; (9) coxa vara due to acute arthritis and to osteomyelitis of the hip; (10) traumatic coxa vara, following fracture or epiphyseal separation; (11) coxa vara of late or adolescent rickets. Finally, in some cases, there is apparently an essential or idiopathic coxa vara.

Treatment is distinguished as orthopedic or surgical. The former includes extension in recumbency; orthopedic gymnastics; immobilization in plaster; *redressement forcé*. The more palliative measures are quite efficient in appropriate cases. The more radical *redressement forcé* may consist in simple stretching of the soft parts, followed by retention in plaster, or, in Lorenz's method—chiefly used in traumatic cases of comparatively recent origin—of infraction of the neck. Certain of these measures are, of course, contraindicated in cases of inflammatory nature. Surgical procedures are permissable only after the evolution of the coxa vara is complete, when bone softening is at an end, and when the deformity is so marked as to interfere markedly with locomotion. The object of operation is to overcome adduction and external rotation. Resection of the head, formerly employed in misconception of the nature of the condition, has been practically discontinued. Osteotomy of the neck was next resorted to, but has been almost entirely displaced by subtrochanteric osteotomy. Some fifteen pages are devoted to a description of the technic of these operations as performed by various prominent surgeons.

In conclusion Perrin asserts that it is the concensus of opinion that operative interference is justifiable in only a small proportion of cases, the indications generally being for rest, extension and immobilization.—*Roades Fayerweather, Baltimore.*

The Operative Treatment of Hallux Valgus and Bunion. By John D. Singley, M. D., Pittsburg, Penn., *J. A. M. A.*, Nov. 22, 1913.

This operation is a modification of the Fowler method and the author claims that it gives a better position for the scar, and a better exposure of the bones operated on.

A saw is used to cut the bone, and in bad cases the head of the metatarsal and part or all of the base of the first phalanx is removed.

Personally I have never had any trouble from the scar on the inner side of the great toe, after the Hueta-Mayo method in a large number of cases. —*Edward S. Hatch, New Orleans.*

The Use of Radiant Heat (Diathermia) in the Treatment of Fixed Flat-foot. By Gustav Muskat. *Zeit für orth. Chir.*, 1913, Bd. XXXII.

In a few treatments the muscle spasm in these cases can be overcome.

Good results are also claimed in swelling in the sole of the foot and in arteriosclerotic spasm.—*Geo. I. Bauman.*

"Apprentice-Scoliosis." By Johannes Elsner. *Zeit. für orth. Chir.*, 1913, Bd. XXXII.

This term embraces those cases of lateral curvature coming on after the child has left school and has taken up active (usually difficult) work. These cases showed little or no curvature during the school period, in fact they have been protected against deformity by not being subject to the severe strain characteristic of the later (working) period. In Schanz's clinic twenty-nine such cases were found among 287 cases of lateral curvature. These cases are reported in detail. They are usually severe and accompanied by pain and tenderness due to strain. Treatment is unsatisfactory owing to the social conditions but if it can be properly carried out the prognosis is good.—*Geo. I. Bauman, Cleveland, Ohio.*

Changes in Respiration in Abbott's Corset. By Philipp Erlacher. *Zeit. für orth. Chir.*, 1913, Bd. XXXII.

A special instrument is used to register the respiratory excursion in different parts of the chest in lateral curvature cases, before and after application of Abbott's corsets. It was found that the excursion on the concave side increased markedly after the application of the corset and it was concluded that the respiratory pressure has a great deal to do with the correction. In applying the corsets therefore respiration upon the convex side and abdominal respiration are restricted as much as possible. As has been observed here, author found that the patients improved a great deal in general health and author thinks that this is due chiefly to the shifting of the heart back to its normal position and to the increase in the lung capacity upon the concave side. Patients should be taught deep breathing before the application of the corset (during the "mobilizing" period) and should continue these exercises after the corset is on.—*Geo. I. Bauman, Cleveland, O.*

Another Case of Congenital Scoliosis. *Giovanni Valtancoli* (*Florence*). *Rev. d'Orth.*, Nov., 1912.

Valtancoli records the case of a girl of 10 years, in whose spine a hemivertebra was interposed, on the right side, between the second and third lumbar vertebræ. The lumbar segment contained five complete vertebræ, and radiographs of the whole spine failed to disclose any further abnormalities. The fact of the congenital origin appears well established. The profile of the lower border of the body of the second lumbar vertebra is altered somewhat in outline. This is also true of the superior border, where the intervertebral disc between this vertebra and the one above (first lumbar) is so thinned out that the two bodies appear to be in bony contact on the left side.

As to treatment nothing is said. Illustrated by reproduction of radiograph.—*Roades Fayerweather, Baltimore.*

Sciolosis and Chronic Appendicitis. By Mayet and R. Delapchier. *Zeit. für orth. Chir.*, 1913, Bd. XXXII, Heft 1–2.

Authors draw the following conclusions:

1. Chronic appendicitis is a frequent cause of lateral curvature (37 per cent.).
2. Operation is indicated and the patient should be treated afterward for the lateral curvature.—*Geo. I. Bauman, Cleveland, O.*

The Treatment of Lateral Curvature of the Spine. By H. W. Wilcox, M. D., Denver. *Colorado Medicine*, July, 1913; Vol. X, No. 7.

This paper is a brief outline of the treatment of scoliosis with a more extensive description of the Abbott method. The author does not report any personal experiences.—*Archer O'Reilly, St. Louis.*

Scoliosis. C. S. Baldwin M. D., Salt Lake City, Utah, *Northwest Medicine*, Feb., 1914; Vol. VI, No. 2.

The author goes into the etiology and pathology of scoliosis in some detail. He sketches briefly the treatment up to the work of Abbott. Of this he speaks very favorably and gives the method in considerable detail. He does not report his own results. Adams' method of applying the Mackenzie Forbes jacket is also mentioned briefly.—*Archer O'Reilly, St. Louis.*

Pathology and Therapy of Flat-feet. By Cramer. *Archiv f. Orthopædie*, Vol. XII, p. 1.

The most important element in causing flat-foot is the weakness of muscles and bones, while the ligaments play a more subordinate passive rôle. Cramer reports the X-ray findings in 118 flat-feet and notes as important changes the lowering of the scaphoid on the astragalus in eighty-five cases and change of the position of the scaphoid against the cuboid in all cases. A wedge shape of the scaphoid was found only in three cases of very severe flat-feet. In twenty-six cases signs of beginning arthritis deformans were seen. The astragalus was found of normal shape in forty-four cases; in forty cases a transverse furrow was seen between the edge of the talocrural and that of the talonavicular joint.

A rational therapy will try to restore the physiological relations of the tarsal bones to each other. For this purpose Ogston's operation has been found of value in severe cases. Cramer has used this method in nine cases with good results.

Ogston's operation consists in an arthrodesis of the talonavicular joint after previous redressement. Cramer has found this operation indicated in cases where the scaphoid was considerably lowered and inward rotated, but where the os calcis had still preserved its position underneath the astragalus. The Achilles tendon is lengthened. In two cases the tendon of the long flexor hallucis was shortened and that of the long extensor hallucis lengthened.—*C. H. Bucholz, Boston.*

Rhachitic Exostosis with Genu Valgum. By Wilmers. *Archiv für Orthopædie*, Vol. XXII.

Wilmers has found rather frequently bony exostoses on sharply curved legs of rhachitic children. The exostoses are always situated on the angle or near to it, on the medial edge of the tibia. On the X-ray pictures he was able to trace the various stages: thickening of the periosteum up to well-developed exostoses. These formations are probably caused by ossification of the insertion of the internal lateral ligament or alike.—*C. H. Bucholz, Boston.*

Madelung's Deformity (Carpus Valgus). By Berg. *Archiv. f. Orthopædie*, etc., Vol. XXII.

Berg considers, in agreement with Springer, Madelung's deformity not as a disease *sui generis*, but only as a symptom, just as scoliosis, flat-foot, etc. This deformity is caused by rachitis adolescentium and should better be called carpus valgus. It is strictly to be separated from deformities caused by injuries or inflammations. Report of three cases from Enderlen's and Riedinger's clinics.—*C. H. Bucholz, Boston.*

Physiological Scoliosis and Its Cause. By Murk Jansen. *Zeit. für orth. Chir.*, 1913, Bd. XXXIII, Heft 1–2.

Author contends that physiological curvature is found frequently in "normal" spines and that the cause is to be found outside of the school.

All theories as to the cause of physiological curvature are based upon some asymmetry in function or in formation and author holds that none of these properly explain the condition. Author has proved (to his own satisfaction, at least) that the cause is to be found in the unequal forces of the respiratory apparatus (*e.g.*, the unequal pull of the diaphragm) upon each side of the spine. Every inspiration, through the pull of the diaphragm, increases the left convex dorsolumbar curvature and deepens the groove in the inframammillary region. The lower, the dorsolumbar curve is the primary one. The position of the bronchi and to a certain extent the blood-vessels aids in the development of the dorsal curve. Division of the right phrenic nerve in the neck in eleven animals caused a left-convex dorsolumbar curve.

Of course the effect of these forces would be most marked in weak or diseased (rachitic) individuals. Author warns against allowing a baby to sit until he is strong enough to do so of his own volition. He would encourage creeping.

Author thinks that the left-sided position of the heart, right-handedness and physiological curvature are all the result of man's assuming the upright position.—*Geo. I. Bauman, Cleveland, Ohio.*

VI. CONGENITAL DEFECTS, INCLUDING CONGENITAL DISLOCATIONS.

Congenital Elevation of the Scapula, with Cicatricial Depression at the Inner Border. By E. Kirmisson. *Rev. d'Orth.*, Jan., 1913.

Kermisson records this case of a three months old infant because of the interesting coexistence with the scapular elevation of a congenital scar (noted at birth) about the middle of the vertebral border of the scapula. This is well shown in the photograph. He compares this scar with those noted on the tibial crest in cases of congenital absence of the fibula, and with the cicatricial depression he has always found at the styloid of the ulna in congenital absence of the radius. He considers them due to amniotic adhesions, which in turn holds responsible, in some way, for the various associated abnormalities of development.—*Roades Fayerweather, Baltimore.*

Congenital Hypertrophy of the First and Second Toes. By Rendu and Loaec. *Rev. d'Orth.*, Mch., 1913.

Report of a case of true gigantism confined to these two toes. Followed by a brief discussion of congenital hypertrophies in general.—*Roades Fayerweather, Baltimore.*

Fascia Plastic in Congenital Defect of the Trapezius Muscle. By Cramer. *Archiv. fuer Orthopædie*, Vol. XII, p. 8.

In a case with complete defect of the trapezius on both sides Cramer has modified Rotschild's method (Zentralbl. fuer Chir., 1910, No. 45) in the following way: After lengthening of the tendons of the pectoralis major and cutting of that of the minor on both sides, the deformity was corrected to a great extent and a plaster cast applied for four weeks followed by exercise and bandaging for another month. Then a piece taken from the fascia lata is suspended between the upper angles of the scapulæ and also attached to the spinous processes. Excellent functional results: The patient can elevate both arms almost completely.—*C. H. Bucholz, Boston.*

Success in the Treatment of Congenital Club-foot. By Chas. R. McClure, M. D., Portland, Ore. *Northwest Medicine*, Feb., 1914, Vol. VI, No. 2.

This is a rather extensive review of the treatment of club-foot intended for the general practitioner, and contains nothing new for the orthopedist. —*Archer O'Reilly, St. Louis.*

Cured Congenital Dislocation of the Hip in a Mongolian Idiot. By Siegfried Peltesohn. *Berlin klin. Wochensch.*, Jan. 5, 1914, p. 14.

Chiefly of interest because of the coexistence of the congenital deformity and infantile myxedema, a rare combination. The patient was four and one-half years old, a boy, and had walked only one year before. The reposition was accomplished by the Lorenz method without anesthesia. Perfect result.—*Roland Hammond, M. D., Providence, R. I.*

Experiences and Results of the Operative Reduction of Congenital Dislocation of the Hip by the Anterior Median Incision. By Ludloff. *Berlin. klin. Wochensch.*, Jan. 19, 1914, p. 106.

The author lays great stress on preparation of the patient as a factor in avoiding postoperative sepsis. With the thigh abducted to a right angle, he makes an anterior longitudinal incision 15 cm. long over the joint. The capsule is opened by an incision parallel to the femoral neck. The capsule is then cut near the base of the acetabulum, and the latter structure is hollowed out to make a place for the head. Reduction is accomplished by pressure on the greater trochanter. Advantages claimed are that the joint is not stiff, and that the dislocation does not recur. Four factors to be dealt with are the iliopsoas, the capsule, the acetabulum, and the head and neck of the femur. He describes in detail the various conditions met with in each of these structures. He has operated upon eighteen joints in fourteen children with good results in all, except in cases of such recent date that the outcome is not yet determined.—*Roland Hammond, M. D., Providence, R. I.*

Luxations of the Head of the Radius, Congenital and Acquired. By Dr. O. Uffreduzzi, *Archivio di Ortopedia*, Dec., 1913, p. 658.

The author divides the cases into three classes: congenital, traumatic and pathological. He has collected forty-nine cases of congenital luxation of which five were submitted to operation. The subject is thoroughly discussed and attention called to the deformity present, viz., curvature of the radius, a twisting of its shaft and increased length. Three cases are detailed. The first was in a child aged four months. The only deformity present was a posterior luxation of both radii. The hands were constantly in a position of marked pronation, the palms facing outward. Supination was impossible even under narcosis. The second case was a chondystrophic dwarf. One radius was luxated posteriorly and the other anterolaterally with curvature of the radius. The third case was a man aged twenty-two. The head of the left radius was felt posterior to the external condyle. There was some limitation of flexion and marked lessening of supination. Operation—an incision 5 cm. long was made on the posterolateral surface. The head of the radius was excised. Another incision 5 cm. long was then made on the outer side of the forearm, avoiding the upper incision, at the junction of the upper and middle thirds of the radius. An osteotomy of the radius was done at this point. Flexion and supination were now possible. Primary healing of the wounds. Passive movements began in fifteen days. Result satisfactory.

He states that isolated luxations of the head of the radius are comparatively rare and are generally accompanied by fracture of the neighboring bones. (In this country more or less complete anterior luxations of the head of the radius, especially in children, are not considered rare, Trans.) A case of a boy aged fourteen is detailed in which the dislocated head was replaced by arthrotomy (advocated in Vol. VIII, p. 583, this journal) with good result. Pathological luxations are due to disease of the joint and are only briefly alluded to—bibliography appended.—*Gwilym G. Davis, Philadelphia.*

The Relation of Arthritis Deformans Juvenilis to Reduced Congenital Dislocation of the Hip. By Peter Bade. *Zeit für orth. Chir.*, 1913. Bd. XXXIII, Heft 1–2.

Author divides the cases into five groups.

1. Many cases show a bony absorption especially in the upper and central parts of the head. This is an osteoporosis due perhaps to the prolonged fixation.
2. Occasionally during or after treatment it is observed that the head divides itself into two or three parts. This may be due to osteomalacia or rickets.
3. Somewhat more frequently it is found before reduction that there is no bony head. These are anomalies of ossification.
4. Bony absorption about the periphery of the head appearing a year or more after reduction. This may predispose to arthritis deformans although clinically he has seen no signs of it.
5. A few cases show a bony absorption in the center of the head (similar to group one) which progresses to entire disappearance of the head.

In practically none of these cases is there any disturbance of function. —*Geo. I. Bauman, Cleveland, Ohio.*

Pes Cavus and Similar Progressive Deformities as a Result of Spina Bifida Occulta. By F. Duncker. *Zeit für orth. Chir.*, 1913, Bd. XXXIII, Heft. 1–2.

Author would differentiate the progressive deformities of the foot of neurological origin from the cerebral (spastic) or spinal paralyses. In substantiation of this classification he reports a number of cases of progressive deformities of the foot due to defects of development in the lumbar spine or sacrum—as shown in the radiographs. Clinically these cases are characterized by their progressive tendency, circumscribed disturbances of sensation and the spastic atrophic character of the paralysis.—*Geo. I. Bauman, Cleveland, Ohio.*

The Relation of Spina Bifida Occulta to Pes Cavus. By Eugen Bibergeil. *Zeit. für orth. Chir.*, 1913, Bd. XXXIII, Heft 1–2.

In thirteen cases of pes cavus radiographs showed the presence of spinal defects in nine. Many of these cases showed no other signs of the presence of such defects. The defect is usually in the fifth lumbar. The deformity of the foot usually first appears during childhood or adolescence. In all such cases radiographs of the lower spine should be taken.—*Geo. I. Bauman, Cleveland, Ohio.*

Answer to Prof. Vulpius' Address on "The Treatment of Congenital Club-foot." By Fred. Schultze. *Arch. f. Orthop. Mech. u. Unfallchir.*, Bd. XIII, H. 1.

A continuation of the old controversy of a few years ago which was abstracted for this journal. Both authors have modified their extreme positions, Vulpius his gentle, tender redressements followed by almost immediate removal of the retaining plaster casts and Schultze his complete overcorrection in one and only one sitting.

Schultze differentiates between deformity of the astragalus and that of the os calcis by means of the X-ray. The deformity of the astragalus can be corrected over König's wedge, that of the os calcis with an osteoclast with the patient in the prone position. He preserves or even increases the equinus position in his efforts to overcorrect the varus and only when the latter is accomplished should the equinus be corrected.—*Walter G. Stern, Cleveland, Ohio.*

Snapping Callus (Cal á Ressort) of the Radius and of the Fibula. By H. Toussaint. *Rev. d' Orth.*, March, 1913.

(The term "*à ressort*" cannot be translated exactly, being used to describe the slight shock, and accompanying clicking noise, with which two parts—generally of a joint—slip past an obstruction in moving upon each other. The word *ressort* means a spring; the English "trigger-finger" is the French "doigt à ressort." In the above title the term indicates the obstructive action of the callus developing after certain fractures of the radius or the fibula.

To quote the author's conclusions:

(1) Following fractures of the radius and of the fibula, in the middle third, there sometimes persists an objective and subjective click, or snap, at the level of the callus, upon supinating the wrist, or abducting the foot, as the case may be; (2) this snap, due to friction of an angular prominence of the bone, fibroid or calcified, upon the interosseous membrane, constitutes a *cal à ressort;* (3) apart from any nerve or vascular lesion, or any lesion of the opposite bone, this callus, of itself, causes a loss of 2 per cent. in working efficiency; (4) the clinical signs should distinguish it at once from a pseudarthrosis; (5) the X-rays penetrate the forming callus too readily to aid much in the diagnosis; (6) the *cal à ressort* needs no surgical intervention, but it requires for its resorption and rapid disappearance early immobilization of the limb. The indication for this orthopedic measure is absolute.—*Roades Fayerweather, Baltimore.*

Epiphyseal Separation of the Metacarpal Bones. By M. E. Gasne. *Rev. d' Orth.*, March, 1913.

The author remarks on the poverty of the literature on this subject. He distinguishes separations at the first from those at the other four metacarpals, and reports two instances of the former and four of the latter. The diagnostic points are noted, especially with reference to distinguishing epiphyseal separations from luxations.

In the thumb, there is normally an epiphysis only at the base of the metacarpal bone; in the other four digits, only at the heads. In the case of the thumb, luxations at the base are always posterior and the distal segments of bone are fixed in flexion; in the author's two cases of epiphyseal separation at this point the displacements were lateral.

In the case of the other four metacarpals, simple luxation generally causes an hyperextension of the first phalanx with flexion of the last two phalanges; in the epiphyseal separations reported by the author all three phalanges were held in extension.—*Roades Fayerweather, Baltimore.*

Pathological Anatomy in Congenital Dislocation of the Hip. By Fr. Schede. *Zeit für orth. Chir.*, 1913, Bd. XXXII.

Author made the following observations:

1. The acetabulum is triangular with the base below and has flat edges.
2. The change in the shape of the acetabulum is due to the pull of the capsule upward.
3. This also accounts for the shifting upward of the point of insertion of the lig. teres and lig. transversum.
4. The absence of the normal pressure of the head in the acetabulum causes the flattening of the edges.
5. In infants the head of the femur was retroverted, in adults anteverted.
6. In both specimens a medio-posterior flattening of the head was found.

—*Geo. I. Bauman, Cleveland, Ohio.*

Genu Recurvatum; Double, Congenital. By J. Curtillet and Pierre Lombard. *Rev. d' Orth.*, July, 1912.

This case presented, in addition to the *recurvatum*, double talipes equinovarus and a luxation at each elbow of both bones of the forearm. Attempts to reduce the deformity of the knees by gradual correction in plaster were unsuccessful and at the age of four and one-half years Wolf's operation was practised on both knees. This consists in transplanting the tibial tubercle with the patellar tendon attached, to a higher level on the head of the tibia. Achilles tenotomies were also done. The functional and anatomic results were good. The elbows required no operative treatment.—*Roades Fayerweather, Baltimore.*

Osteomyelitis of the Sacrum. By P. Grisel. *Rev. d' Orth.*, July and Sept., 1912.

The subject is considered under the main headings of pathology, clinical features and treatment. Twenty-seven cases, reported in the literature, are reviewed, and three new cases are put on record. The lesion is situated generally in the lateral mass of the sacrum. In no instance has a focus been found confined to the anterior median part of the sacral vertebræ.—*Roades Fayerweather, Baltimore.*

Changes in the Acetabulum after Reduction of Congenital Dislocation of the Hip. By G. Nové-Josserand. *Rev. d'Orth.*, July, 1912.

The full bony reorganization of the acetabulum is shown by X-ray studies to be long delayed—six years in one-fourth of the cases. Only three cases are available for autopsy study of the alterations occurring sufficiently long after reduction to show changes in the contour and depth of the acetabulum. These are compared with the acetabulum removed at autopsy in an unreduced case. The changes comprise three periods. During the first few weeks after reduction the pressure of the replaced head slightly deepens the cavity by causing the disappearance of the adipose tissue that the latter contains. During the second period a cartilaginous rim is developed at the posterior border of the acetabulum. In the average case this is solid enough at the end of eight months to retain the head and allow normal use of the joint. The third stage, that of ossification, begins late and proceeds slowly, being completed only after some years. An exact explanation of the development of the posterior rim after reduction is lacking, but it is apparently not due to pressure of the femoral head, to which so much importance has been attached.—*Roades Fayerweather, Baltimore.*

Etiology and Treatment of Congenital Club-foot. By Jas. Fränkel. *Zeit für. orth. Chir.*, 1913, Bd. XXXII.

Author lays some stress upon the hereditary influence in the etiology of congenital club-foot. He speaks of the recurrence of this deformity in families where there was an unusual difference in size between father and mother. In some of his cases there were such complications as placenta previa, tumors, unusually abdominal or back pains during pregnancy, previous operations for retroflexion or unusual position at birth or twisting of the cord about the foot. In some families many cases were reported. The etiology of the congenital cases with paralysis is little understood. One case was found on X-ray examination to have a spina bifida occulta.

In the treatment operations are to be avoided and author considers it better to overcome the deformity a little at a time than to try to do it all in one sitting. He is opposed to tenotomy. Tenotomy of the tendo Achillis makes correction of the supination very difficult or impossible. If it must be done it should only be after the foot is in pronation. He uses and recommends correction by special straps and adhesive plaster, the foot being placed in an "hyperemia box." The mechanical features of this treatment can best be understood by referring to the illustrations. When the foot is fully overcorrected it is put in plaster and kept fixed for three to nine months, the plaster being removed every four to six weeks.

After the plaster the foot is kept in a brace until the position is thoroughly established. The rotation of the leg practically always disappears during the plaster stage. Even adult club-foot was corrected in this manner. Muscles return practically to normal and he maintains that altogether better cosmetic and functional results are obtained. He reports a long series of cases with photographs and history.—*Geo. I Bauman, Cleveland, O.*

Two Cases of Cervical Rib with Vascular Symptoms. By E. D. Treford, F. R. C. S. Eng. *Lancet*, Oct. 18, 1913.

CASE I.—Man of twenty-seven. Right index-finger numb and white, condition gradually extending to thumb and middle finger, and in a year involved whole hand. Neuralgic pains in forearm. Whole arm resembled that of a corpse. Tactile, pain and temperature sensations normal—no trophic lesions. A well-developed cervical rib articulated with the first dorsal rib at a point about its middle. Rib removed in part—the subclavian artery was not compressed by it. A very complete recovery ensued, the pulse beginning to return four months after operation.

CASE II.—Woman of twenty-nine years. Numbness, pain and gangrene of finger tips were noted. No arterial pulsation below coraco-brachialis insertion. Tactile, pain and temperature sensations normal. A cervical rib was present, but at operative removal (in part) it was seen that there was no pressure upon subclavian artery. Patient steadily improved, and now complains of nothing. Pulse, however, still ceases below level of middle of upper arm.—*J. Appleton Nutter, Montreal.*

Three Cases of "Flying" Scapula. By Dr. W. A. Campbell. *Glasgow Medical Journal*, Nov., 1913.

1. A woman who had been subjected to an extensive operation of glandular tubercle, as a result of which the nerve supply to the trapezius, viz., the spinal accessory and twigs from the third and fourth cervical nerves,

had been severed. The "flying" was marked, and she demonstrated well how such patients overcame the disability of not being able to raise the arm above the horizontal at the side by making use of upper half of the pectoralis major.

2. A miner, due also to trapezius paralysis, arising from a sudden wrench downward of his shoulder, causing a tear of the third and fourth cervical twigs.

3. Due to palsy of the nerve of Bell, and affecting the serratus magnus, or serratus anterior muscle. This also due to a sudden depression of the shoulder by a blow.—*J. Appleton Nutter, Montreal.*

VII. TRAUMATIC LESIONS, FRACTURES AND DISLOCATIONS.

Recurring Dislocation of the Shoulder. By Raymond Grégoire. *Rev. d' Orth.*, Jan., 1913.

An anatomical study, in which the author offers an explanation of the cause and mechanism of these dislocations that occur on slight provocation. While his conclusions are plausible, no mention is made of the source or amount of his material; the latter is evidently slight. The article is worth a review.

The essential cause has generally been described as an attenuation and distention of the capsule, with at times a partial disinsertion from the anterior border of the glenoid cavity. But for the author the essential lesion is a congenital malformation of the humeral head, which presents a notch in its posterior part. The presence of this notch (*Encoche*) has been noted by several observers in resections of the head for recurring dislocation, but they have attached only a secondary importance to it. Only a wide exposure of the joint permits this portion of the head to be seen; hence the small number of observations. The notch has always the same general shape, as if a wedge, the shape of a section of orange, had been removed, but the size varies. Its walls are smooth, regular and glistening.

A similar deformation is noted in the posterior part of the head in cases of old traumatic dislocations, only here the outlines are irregular and present other evidences of traumatic action.

The author's contribution is the study of the internal architecture of the head in recurring cases. He finds here a regular arrangement of trabeculæ, as in the normal head, but in marked contrast with the distortion in old traumatic cases. This in his opinion is sufficient proof of the congenital nature of the notch in the recurring cases. He has further noted the same deformity in a case with no history of dislocation; here the capsule was not relaxed but it was attenuated and the coraco-humeral ligament was absent.

Grégoire concludes, therefore, that in these recurring dislocations the deformity of the head and the anomalies of the capsule antedate the dislocations and instead of being the results are the predisposing causes of the luxation. The mechanism of the luxation, he believes, is as follows, and may be caused by comparatively slight trauma. The arm is elevated in abduction and in external rotation; the abnormally weak capsule yields and the notch locks on the anterior border of the glenoid cavity; further forcing produces the dislocation. Illustrations showing radiographs of horizontal sections through normal and dislocated heads of both types, serve materially to enforce the author's contentions.—*Roades Fayerweather, Baltimore.*

The Bloodless Treatment of Pseudarthrosis of the Neck of the Femur. By Adolf Lorenz. *Zeit für orth. Chir.*, 1913, Bd. XXXII.

Nailing is usually useless in these cases and more serious operations are not justifiable. Disability is due chiefly to the position, especially the flexion and adduction and to a less extent the rotation and shortening. These malpositions should be overcorrected and union obtained if possible, and author claims this is possible by breaking down any present union, rubbing the ends together and putting the leg and hip in plaster for three to five months. During most of this time patient gets around with crutches. Of course union does not take place in all cases but all cases are markedly improved.—*Geo. I. Bauman, Cleveland, Ohio.*

The Value of the Operative Treatment of Fractures (Osteosynthesis). By Troell. *Monatsschr. f. Unfallheilk.*, 1913, 9. Abstr. in *Zeitschr. f. orth. Chir.*, Bd. XXXIII, H. 3-4, p. 658.

In the Seraphim hospital in Stockholm were treated 3106 fractures from 1885 to 1910. Of these, 6 per cent. were treated by open operation. Fractures of the olecranon and the patella were always operated upon unless there was some special contraindication. Second, fractures were operated upon if it was impossible to secure such reduction and apposition that a good functional result could not be expected. Postoperative infection occurred in 5.6 per cent. of the cases of simple fracture operated upon, and in 41.8 per cent. of the compound fractures. Open operative treatment has a higher mortality than the conservative treatment. In eighty-seven cases operated upon the functional result was good in 83.6 per cent., in joint fractures, 89.5 per cent.

Osteosynthesis in patellar and olecranon fractures gives the best results when performed early and without a delay of one or more weeks. Passive motion should be begun soon after the operation.—*A. Bruce Gill, Philadelphia.*

The Symptoms and Diagnosis and Treatment of Fractures about the Elbow. By W. D. Haines, M. D., Cincinnati. *Lancet Clinic*, October 18, 1913, Vol. CX, No. 16.

A guarded prognosis should be given in all cases of fractures about the elbow-joint, and the patient should be told that limitation of motion, pain, and interference with function may persist. The presence of an old injury should be looked for, as that may complicate the prognosis. In all cases an examination under an anesthetic should be made, and additional fractures sought. An X-ray should always be made when possible.

Fracture of the olecranon is probably the most frequent. This is usually a clean break without much separation. It can ordinarily be treated by complete extension. If there is much separation or rotation, or where complete function is necessary, and to hasten the time of treatment, operation is advisable in patients under fifty.

Fractures of the shaft, head and neck of the radius are not infrequent complications of other fractures in this region.

Fractures of the condyles are relatively frequent. The degree of deformity depends upon the extent of the damage to the ligaments. In fracture of the internal condyle usually a greater portion of the joint surface at the lower end of the humerus is involved, with considerable injury to the ligaments, usually accompanied by muscle rotation of the fragment. If rotation cannot be overcome, the fragment should be exposed and fixed, or removed. *Archer O'Reilly, St. Louis.*

A Plea for the Immediate Operation of Fractures. By Charles G. Levison, M. D., San Francisco, Cal. *State Journal Medical*, February, 1914, Vol. XII, No. 2.

The author does not maintain that all fractures should be operated immediately, or that all fractures should be operated. Operation is not advisable in these cases which can be treated in the usual way. There are some cases in which operation is desirable and in which the period of convalescences can be hastened, as in fracture of the femur.

If the technic is properly carried out there is practically no more danger of infection than with a later operation. No one, however, should attempt an immediate operation, whose technic is not absolutely perfect. The operation is carried out according to the technic Lane and the finger should never be introduced into the wound.

An advantage of an immediate operation is the case of reduction. Displacements are the result of violence, and contractions occur later. Later the muscles and tissues lose their pliability as a result of induration, and coagulation of escaped blood. Callus begins to form in about ten days which also makes later reductions more difficult.

Compound fractures should never be operated or explored immediately but should be allowed to heal. Also only fractures that have resulted from direct violence should be operated immediately.—*Archer O'Reilly, St. Louis.*

The Operative Treatment of Fractures. By Willard Bartlett, M. D., of St. Louis. *The Cleveland Medical Journal*, July, 1913, Vol. XXII, No. 13.

The author gives his experience with the treatment devised by Lane, Codavilla and Steinmann, the latter two are closed together. The details of the treatment are given, and three of forty cases are reported. The author believes the method most valuable in these cases in which traction is necessary.

The description of Lane plating is more extensive. It contains an abstract of a paper on this subject, by Lane in the *British Medical Journal.* That author states that he had treated seventy-seven (77) fractures by plates, but reports on only thirty-nine as the others have not been seen after leaving the hospital. Thirteen of these thirty-nine are known to have had the plates removed, and seven were failures. In four cases plates were imbedded suppurating wounds. The results in these were successful. Probably due to flooding of the wounds with iodine and packing.

The author believes that the patient's occupation is an important factor in determining whether or not to plates, using the plate when the best functional result is desired. He also plates under the following conditions:

"(1) When a leg case was to be gotten out of bed early; (2) in old cases of nonunion or extreme malunion; (3) it is, of course, desirable in all fresh widely open fractures, if shock be past; (4) in chronically infected cases, in which the bones lie bare. All compound wounds, whether suppurating or not, are to be packed and allowed to granulate. Generally speaking, the patient must always be a good surgical risk."

"Hardly any operative procedure is wholly without risk; hence I feel that we must, before submitting any bone case to operation, show very definitely why we are assuming even the moderate operative risk here involved."—*Archer O'Reilly, St. Louis.*

Total Dislocation of the Cervical Spine. By Malkwitz. *Archiv für Orthopædie, Mechanotherapie und Unfallchir.*, Vol. XI.

Malkwitz reports eleven cases of total dislocation of the cervical spine with no signs of any affection from the part of spinal cord. Symptoms were: pain, stiffness, limitation of motion and a faulty position: The neck was carried forward, while the head was much flexed backward. The mechanism of injury was in most cases indirect. The lower three vertebræ were most frequently affected.

Malkwitz has made experiments on the cadaver, which showed that total displacement of vertebræ may simply cause an S-like curve of the spinal cord without any injury to its structure.—*C. H. Bucholz, Boston.*

Treatment of Fractures of the Internal Epicondyle. By Hartmann. *Archiv für Orthopædie*, Vol. XI. *Mechanotherapie u. Unfallchirurgie.*

In fractures of the inner epicondyle, as long as the fragment is still in connection with the condyle, Hartmann recommends to fix it by adhesive-plaster strap after reduction under ether. When the epicondyle is more displaced and completely torn off, he makes reduction by an open incision and fixes the fragment with a nail. Plaster cast for two to three weeks and exercise treatment afterward give good results.—*C. H. Bucholz, Boston.*

Sprain Fractures of the Wrist. By Kellogg Speed, Chicago. *Surg., Gyn. and Obs.*, Aug., 1913. Cracks in epiphysis of radius. Tearing off of ligaments on sides of radius with periosteum. Fractures of ulna, styloid and of the interosseous membrane. Cracks of scaphoid.—*Z. B. Adams, M. D.*

Reduction of Shoulder Dislocations. By Julius Caesar, F. R. C. S. Irel., *Lancet*, Jan. 24, 1914.

Description of author's method, used by him with success for past twenty-five years.

Patient sits on the ground. The wrist of the injured side is then grasped, an assistant doing same to wrist of sound side. "We then raise both arms straight above the head, taking care to keep them parallel, and extending them upward till the patient is just raised from the ground, at which point a click is heard and felt and the dislocation is reduced without further manipulation except that occasionally in cases of subscapular dislocation it may be necessary to slightly rotate the arm from right to left in the case of left, and from left to right in that of the right arm. These movements are of course carried out during extension."—*J. Appleton Nutter, Montreal.*

VIII. APPARATUS AND X-RAY.

The Two-piece Chair-back. By Adolf Lorenz. *Zeit für orth. Chir.*, 1913, Bd. XXXIII, Heft 1–2.

Author recommends a chair the back of which is in two-hinged parts. This can be adjusted to fit the back accurately.—*Geo. I. Bauman, Cleveland, O.*

New Apparatus. By W. F. J. Milatz. *Zeit für orth. Chir.*, 1913, Bd. XXXIII, Heft 1–2.

This article consisting of the description of several new forms of apparatus does not lend itself well to abstracting. Refer to illustrations.—*Geo. I. Bauman, Cleveland, O.*

Concerning the Nature of Arthritis Deformans. By G. Axhausen. *Zeit für orth. Chir.*, 1913, Bd. XXXII, Heft 1–2.

Several small areas of necroses were produced in the knee-joint of a dog. In the course of a year there developed a typical deforming arthritis.—*Geo. I. Bauman, Cleveland, O.*

IX. MISCELLANEOUS DISEASES, GENERAL ORTHOPEDIC ARTICLES. PHYSICAL THERAPY.

Experimental Tenoplasty. Dr. Giuseppe Bolognesi. *Archivio di ortopedia*, Dec., 1913, p. 599.

The author experimented on rabbits by resecting a piece of a tendon and inserting in the gap a strip of fibrous tissue from the lumbar aponeurosis of a rabbit or a piece of varicose vein or hernial sac taken from man. If the operation is done with a proper technic as regards absolute asepsis; proper conservation of the implanted tissue; with care not to have the skin cicatrix directly over the graft; with sufficient length of graft tissue and with daily postoperative examination and early movements, there is then formed a connective-tissue cord perfectly continuous with the end of the resected tendon which in most cases is not in the slightest degree adherent to the surrounding tissues. The graft gradually disappears and is substituted by new tissue. Adhesions are best avoided by using a hollow cylindrical graft the cavity of which serves to conduct the new-formed tissue while its walls tend to prevent the formation of adhesions to the adjacent structures. The article is illustrated by fifteen microscopical sections.—*Gwilym G. Davis, Philadelphia.*

Atrophy of Muscles and Joints in its Relation to Joint Injuries and Diseases and their Fixation. By Robert W. Lovett.

Author reviews the various theories regarding the cause and nature of muscle and bone atrophy in joint injury cases and reports several instructive cases. In the knee cases of muscle atrophy there is an involvement of the thigh muscles, absence of severe joint changes and an increase of lateral motion.

Bone atrophy is always accompanied by muscle atrophy and there is local pain, tenderness, and swelling, muscle spasm, restriction of motion and disturbances of circulation.

In every case of synovitis, fracture or arthritis there is muscle atrophy persisting, many times, after the healing of the joint.

Treatment of bone or muscle atrophy consists in careful massage, baking, passive hyperemia and active gymnastic exercises followed by early use.—*Geo. I. Bauman, Cleveland, O.*

The Periosteum in Bone Transplantations. Is Contact With Living Bone Necessary For the Life of Grafts, and Will Transplanted Periosteum Produce New Bone? Clarence A. McWilliams, M. D., New York, *J. A. M. A.*, Jan. 31, 1914.

These experiments were made to prove or disprove the question, the whole article is well worth reading, and the conclusions reached are as follows:

I. The theory that contact with living bone is necessary for the subsequent life of grafts must be given up.

II. Living bone grafts have life inherent in themselves and are capable of permanent growth even when transplanted into soft parts.

III. The life of grafts is dependent on a sufficient blood supply. This is surely obtained when periosteum is on the grafts, since practically 100 per cent. of such grafts are successful, whether the transplants be in contact with living bone or not, or whether they be grafted into the soft parts and not in contact with living bone.

IV. Forty-eight per cent. of my bone grafts without periosteum were successful whether contact with living bone was made or not. This goes to show that there is some other factor present making for the life of grafts, than the periosteum or contact with living bone, and this I take to be a sufficient blood supply. Since it is impossible to tell beforehand when grafts without periosteum will attain this sufficient blood supply, the lesson is evident that grafts should always be transplanted with as much of their attached periosteum as possible.

V. Periosteum transplanted into the soft parts will produce new bone in a certain proportion of the cases.—*Edward S. Hatch, New Orleans.*

The Practical Uses of Free Transplantation of Tissues. By Lexer, *Münch. med. Wochenschr.*, 1913, 37 and 38. Abstract in *Zeitschrift. f. orth. Chir.*, Bd. XXXIII, H. 3–4, p. 662.

The author enumerates the tissues that may be successfully transplanted: skin, mucous membrane, fat, blood-vessels, tendons, fascia, and bone. He discusses the indications for transplantation. Lexer has successfully transplanted entire joints.—*A. Bruce Gill, Philadelphia.*

Transplantation of Bone. By Putti. *Arch. di. ortopedia.* Anno XXX, Fas. II, 1913. Abstr. in *Zeitschrift. f. orth. Chir.*, Bd. XXXIII, H. 3–4, p. 659.

Putti reports the transplantation of bone in six cases. (1) A piece of the fibula 19 cm. long was transplanted to fill a defect in the femur due to the removal of a periosteal sarcoma. (2) A piece of the tibia was used to replace the second and third metatarsals removed for tumor. (3) and (4) In pseudoarthrosis of the humerus a piece of the tibia was transplanted to secure union. (5) A similar operation was performed in the forearm. (6) In a child of four and one-half years who had union of the bones of the leg in malposition a wedge-shaped piece of bone was resected and a transplant inserted.—*A. Bruce Gill, Philadelphia.*

Transplantation of Bone. By Putti. *Soc. med.-chir. di Bologna*, 2 Mai, 1913. Abstr. in *Zeitschrift. f. orth. Chir.*, Bd. XXXIII, H. 3–4, p. 660.

Putti reports eight other cases of bone transplantation. (1) The head and neck and part of the shaft of the femur was resected for sarcoma. The entire fibula of the same limb was transplanted to fill the defect. The healing in of the transplant was perfect. The transplant suffered a fracture at the end of six months but good union followed. A year after the operation there was good function of the limb, but the patient died of visceral metastases. (2) Pseudoarthrosis of the humerus. After four months there was spontaneous fracture of the transplant. (3) Pseudoarthrosis of the radius and the ulna. After eight months there was full healing and complete restoration of function. (4) Pseudoarthrosis of the humerus Good result. (5) Diffuse osteochondroma of the second and third metatarsals. A piece of the tibia was transplanted to fill the defect. Good result. (6) Pseudoarthrosis of the leg in a case of osteomalacia. A piece of tibia from another patient was transplanted. Good consolidation at the end of three months. (7) Arthroplasty of the knee was performed in a case of bony ankylosis. A piece of the fascia lata was transplanted between the ends of the bones. (8) Fracture of the malleoli and complete luxation of the foot. The author lengthened all the tendons at the ankle, cut the fibula at the site of the fracture and inserted a piece of the tibia between the two ends and reduced the luxation. Good anatomical and functional result at the end of three months.—*A. Bruce Gill, Philadelphia.*

Prosthesis to Enable Cripples to Work. By Hoeftman. *Ceitschrift. f. orth. Chir.*, Bd. XXXIII, H. 1-2, p. 112.

The author presents a well-illustrated article demonstrating how persons who have had amputations of their extremities may be enabled to work by means of various appliances fastened to the stumps of the amputated limbs. If a hand has been amputated a cuff may be fitted to the arm. This cuff contains a socket into which many kinds of instruments and implements may be fitted and employed almost as well as if they were grasped by the hand. Pen, knife or fork, all kinds of wood-working instruments, hooks or rings for grasping and pulling, hammers, hatchets, crochet needles—all these and many implements besides may be employed by men and women who have lost a part of either one arm or of both arms.

Artificial legs may also be made to enable the man who has lost a lower limb to walk about and to operate machinery with his feet.

Indeed there seems to be no limit to the results that may be obtained in these cases by the exercise of patience and ingenuity.—*A. Bruce Gill, Philadelphia.*

The Prophylaxis of Physical Deformities among Infants. The Orthopedic Inspection in the Public Schools of Bordeaux. By J. Gourdon. *Rev. d' Orth.*, Nov., 1912.

This article comprises a detailed consideration of the subject under the following heads: (1) Methods of Inspection in the Schools of Bordeaux. (2) Results of the Inspection, May 1, 1909 to June 1, 1912. (3) Discussion of so-called School-room scoliosis. (4) Necessity of Orthopedic Inspection in Schools. (5) How Orthopedic Inspection in Schools should be conducted to be efficient. (6) Comparison of French and Foreign Methods of Orthopedic Inspection in Schools.

Under the second heading it is interesting to note the following: Total examined, 1485 cases; scoliosis, 445; "pre-scoliotic condition," 165; kyphosis, 91; kypho-scoliosis, 47; congenital dislocation of the hip, 30; infantile paralysis, 23; spastic paraplegia, 4.—*Roades Fayerweather, Baltimore.*

Orthopedics for the General Practitioner. By James Warren Sever, M. D., Boston. *Interstate Medical Journal*, Feb., 1914, Vol. XXI, No. 2.

This paper as the title would imply is addressed to the general practitioner. The author takes up the following conditions:

1. Limping in children.
2. Lateral curvature of the spine.
3. Congenital club-foot.
4. Synovitis of the knee-joint.
5. Infantile paralysis.

Their discussion is rather elementary and the paper contains nothing new or original.—*Archer O'Reilly, St. Louis.*

Orthopedic Hospitals and Vocational Training for Cripples. By Charles F. Painter, M. D., Boston. *Lancet-Clinic*, Aug. 30, 1913, Vol. CX, No. 9.

This paper gives a brief history of training schools for crippled children and points out the development from the home for crippled children and the poorhouse to the present training schools, and hospitals combined with training schools.

The author points out the great improvement in the condition of the children in these later institutions and also shows the economical advantages in making the cripple self-supporting.

There are four methods of more or less prominence adopted for the care of crippled children, the home for incruables or almshouse method, which is antiquated; the day school where the children are transported to and from school, and are given common school education and industrial training this has accomplished a good deal; the combination of the hospital and the training school is probably the best method, as it allows better care and treatment of the crippled child; the fourth method is the special class for cripples in regular public schools, this has the disadvantage that the patient is pitted against the healthy child, it is more difficult to keep up and at the same time the opportunities for care and treatment are lacking. In all cases the home ties should be maintained as closely as possible.

A list of the more important of the institutions in this country and abroad is given with a brief description of their method of handling the problem.—*Archer O'Reilly, St. Louis.*

History of Orthopedics. By Muirhead Little, President. *Lancet*, Dec. 6 1913. **Inspection of Orthopedics.** *Royal Society of Medicine.*

An interesting address on the occasion of the first scientific meeting of the newly established subsection, Nov. 4, 1913. In it Mr. Little tells of the formation of the word "Orthopedia" by Dr. Nicholas Audrey of the Faculty of Physics at Paris, and published by him in 1741.—*J. Appleton Nutter, Montreal.*

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